JUNIOR HIGH SCHOOL CURRICULUM GUIDE FOR INDUSTRIAL ARTS

DEPARTMENT OF EDUCATION
EDMONTON, ALBERTA
SEPTEMBER, 1964

TABLE OF CONTENTS

NOTE: Equipment and Audio-Visual Aids lists are available from the Industrial Arts office upon request.

JUNIOR HIGH SCHOOL CURRICULUM GUIDE FOR INDUSTRIAL ARTS

Introduction

Industrial education in Canada has gone through a period of rapid change. In Alberta this change has resulted in a critical examination of the industrial arts program, culminating in a revised course designed to meet the needs of students who must become aware of a highly technological society.

Some of the major developments which are having an impact on the educational environment are: (1) Increased industrialization and technological developments which have produced changes in both the occupational classifications in Alberta and requirements for entrance into occupations; (2) Increased mobility of the population in Alberta and Canada which has resulted in attempts to equalize education opportunities in rural and urban centers; and (3) Increased and more diversified student population currently in secondary schools.

The establishment of vocational education facilities in the Province of Alberta has provided an impetus for curriculum committees to examine the content of subject areas in the secondary schools. Prior to the establishment of the new vocational education facilities, industrial arts in Alberta performed a dual function: that of contributing to general education in the junior and early senior high school program, and that of providing vocational education in the final years of the senior high school program. This dual function is no longer necessary; it is certainly not desirable.

The committee responsible for outlining the industrial arts program which follows has kept these facts in mind. The committee considered it important to examine the literature on industrial arts education. The quotations which follow have been selected to illustrate some of the major statements of purpose of industrial arts.

Contemporary Thought in Industrial Arts Education

Frederick Bonsor and Lois Mossman indicated the purpose of industrial arts when they formulated a definition of this subject area nearly forty years ago. Their definition has been the most widely quoted one in the history of industrial arts.

> "The industrial arts are those occupations by which changes are made in the forms of materials to increase their values for human usage. As a subject for educative purposes, industrial arts is a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes."[1]

1. F. Bonsor and L. Mossman, Industrial Arts for Elementary Schools, 1924, Macmillan Co., New York. pp. 3-18.

In 1957, Hornbake made the following statement:

> "The acceptance of industrial arts into the family of school disciplines assumes that the world of work, particularly the phenomena of industry, constitutes a legitimate area of study. Can a person who lives in an industrial democracy lay claim to being an educated person if he has not become aware of the basic processes by which society maintains itself." [2]

Hostetler and Young, Professors of industrial arts at North Carolina State College stated:

> "If we over simplify the total task of education and agree that the central purpose of education is to enable the student to solve all of his problems (emotional, social, communicative, vocational, etc.) we would then say that the purpose of industrial arts is to provide experiences which will enable the student to solve the technical problems of living in a highly industrial age. The experiences provided should give the student an opportunity to apply science, mathematics, and other facets of his general education to the solution of practical problems in the industrial arts shop. Industrial arts is the general education aspect of the industrial education complex. It is general education in that it is not specialized. These experiences are not those which prepare for a trade or vocation, but are designed to familiarize the student not only with materials, processes, and tools of industry but also with industry as science and invention - as a means of producing goods and services - and as a unique pattern of human relationships. Industrial arts is designed to provide general orientation and basic skills and experiences which may become a basis for making vocational decisions and for further study in the industrial-technical complex." [3]

Feirer, editor of the Industrial Arts and Vocational Education Magazine, made the following statements with regard to the purpose of industrial arts:

> "A good industrial arts program affords students an insight into American Industry, the source of raw materials, how basic materials are processed, how products are designed and produced, and how people earn a living."

2. L. Hornbake, "Philosophical Viewpoints", American Council on Industrial Arts Teacher Education, A Sourcebook of Readings on Education. 6th Yearbook, (Bloomington, Illinois: McKnight & McKnight Publishing Co., 1957), pp. 14-15.

3. I. Hostetler and T. B. Young, A Guide to Curriculum Study - Industrial Arts. (Raleigh, North Carolina: State Board of Education, 1959), p. 3.

A summary of the few statements quoted above and of industrial arts literature in general illustrates that there appears to be consensus on the following points:

(a) Industrial arts education is a part of general education.

(b) Industrial arts education is concerned with interpreting the world of work with industry a salient component, to all youth.

Functional Objectives of Secondary Education

It is important that instructors of industrial arts visualize their role as a part of general education. To facilitate this the functional objectives of secondary education in the Province of Alberta are included below.

1. Personal Development

The prime aim of the school is to assist each Alberta youth in his growth towards maximum self-realization. Definite goals of physical fitness, mental health, and intellectual achievement are included under this heading.

(a) ability to think rationally, to express thought clearly and to read and listen with understanding.
(b) a broad understanding of the methods of science, its major findings and its influence on human affairs.
(c) a broad understanding of the fundamental principles of mathematics and their importance in daily living; a mastery of mathematical skills necessary for vocational competence.
(d) an understanding and appreciation of cultural heritage.
(e) the development of suitable recreational and leisure-time activities.
(f) the development of character manifested in sound habits of behavior in social relationships.
(g) The development of a pattern of values, attitudes, and ethical ideals which generalize and furnish justification for good habits and culminate in a philosophy of life which recognizes the importance of religion.

2. Growth in Family Living

Each Alberta youth must learn to appreciate the unique and indispensable place in society played by the home and family with specific attention to the influence of the family unit upon right thinking in connection with morals, institutions, and the current issues of democratic living. The school should assist him to achieve a better understanding and appreciation of:

(a) The responsibilities and privileges of the members of the family group.
(b) The home as a democratic institution.
(c) The conditions essential to successful family life.
(d) The opportunities for enjoyment at home.
(e) The functions and responsibilities of parents.
(f) The relationship of the family to its neighbors and the community.

3. Growth Toward Competence in Citizenship

Each Alberta youth must be brought gradually to a realization of his position and responsibilities in the school, community, province, nation, and finally in the community of nations. The school should guide him in:

(a) Acquiring insight into the historical background of contemporary society.
(b) Developing competence in meeting, and attempting to solve, public problems and issues which citizens are required to encounter and on which they must take action.
(c) Developing competence in political action at the school, community, national, and world levels.
(d) Developing consumer competence.
(e) Developing democratic attitudes and behavior in all social situations.
(f) Establishing loyalty to the ideals of democracy and acquiring an appreciation of his community, the province and the nation.

4. Occupational Preparation

The school must help each Alberta youth to develop those understandings and attitudes that will make him an intelligent and productive participant in economic life; and assist him to develop saleable skills, or prepare him for post-school vocational training. The youth should:

"(a) Become familiar with the range of vocational opportunities open to him.
(b) Learn how to take full advantage of the school and extra-school guidance services.
(c) Achieve an acceptance of his own capacities as indicated by professional analysis of interests, socio-economic status, aptitudes, personality, and native intelligence." [4]

4. Curriculum Guide for Alberta Secondary Schools, 1950. pp. 15-17.

Functions of the Junior High School

The Department of Education in Alberta has stated specific functions for the junior high school which are in addition to the functional objectives of secondary education. It is important, therefore, that instructors of industrial arts interpret the junior high school industrial arts program not only in relation to the functional objectives of secondary education, but more particularly to the achievement of the functions of the junior high school. For this reason they are included below:

"1. To provide a setting in which the adolescent is understood and which makes possible a smooth transition from the elementary to the senior high school.

2. To continue the training of the elementary school in basic skills and knowledge and to broaden this training to include more opportunities for students to think critically and to draw generalizations.

3. To provide for the mental, physical and aesthetic needs of students and to develop talents in these areas.

4. To provide opportunities for the development of acceptable social, moral and spiritual values.

5. To help pupils discover special interests and abilities that will enable them to set realistic educational and vocational goals." [5]

Objectives of the Industrial Arts Program

Within the broad framework established by the functional objectives of secondary education and the more specific functions of the junior high school, the subject area of industrial arts has a most important role. The objectives and desired outcomes listed below for industrial arts establish the purpose of the industrial arts program; indicate the relationship of industrial arts to general education, and indicate the subject matter for industrial arts.

Specific Objectives

1. To develop an understanding of the productive aspects of society.

2. To provide exploratory experiences in the various technologies prevalent in the world of work.

3. To provide an opportunity for students to apply their skills in mathematics, science, and English to the solution of practical problems.

4. To provide an introduction to the multiplicity of occupational opportunities.

5. Junior High School Handbook. 1962. p. 4.

5. To develop an attitude of safety with a respect for safe working habits and practices in the use of tools, equipment and materials.

6. To develop an attitude of personal and social responsibility.

7. To develop a degree of manual skill necessary to satisfactorily complete the requirements of each unit attempted.

8. To provide experiences which permit the growth and expression of individual creativeness.

Definition of Terms

The following are terms that will be used with the revised industrial arts program:

1. Multiple Activity Laboratory - a laboratory or shop where three or more activities are in progress at the same time.

2. Course Area - Area is the general title given to the basic technologies represented. A course area may include one or more units, e.g. electricity-electronics has two units.

3. Course Unit - A unit consists of from nine to twelve weeks of work in an area. There may be several units to complete a course area.

4. Pre-designed Projects - Students at the junior high school level do not have the background of knowledge of tools and materials to design their own projects. The instructor should select or design projects to meet the objectives of the course.

5. Instruction Sheets - These are written teaching aids which contain organized material for the use of individual students. There are four common types:

   (a) Operation Sheet - gives directions on how to perform a single manipulative task. This would include the directions to operate a machine.

   (b) Job Sheet - gives directions on how to do, completely and in proper sequence, a number of operations. The procedure for making a project or doing an experiment would constitute a job sheet.

   (c) Information Sheet - contains everything necessary for the understanding of an instructional unit which is largely informational in nature.

   (d) Assignment Sheet - directs the study to be done by the student on the lesson topic, and may include questions to determine how well the lesson has been learned.

JUNIOR HIGH SCHOOL PROGRAM

(a) The Multiple Activity Program

The multiple activity program is an organizational device by means of which a variety of exploratory experiences can be presented with a minimum of room and equipment. The shop is organized into nine different sections representing the course areas. Each section or bay is large enough to accommodate up to six students. These bays are as self-contained as possible with provisions made for the storage of tools and projects within them. The class is divided into three or more groups with each group working through the course unit in the bay assigned it. After the completion of the unit in from nine to twelve weeks the groups rotate each proceeding to another bay.

As the units consist of from nine to twelve weeks of work, each depending on the number of areas in operation, there will be several weeks unaccounted for. This time, two to four weeks should be used at the beginning of the year to organize the activities of the groups, draw the first project for one area, teach the beginning lesson of each unit, give demonstrations and provide the information required to get each group started efficiently in their assigned areas.

Once group work begins, the instructor would move from one area to the next giving short lectures and demonstrations each period. The remaining time he would give individual help.

Another method would have the instructor present his lecture and demonstrations to the class as a whole. The lessons would rotate from group to group with material from their respective units. Information sheets would supplement the lesson for later review when the information becomes pertinent to the unit the student is in. The instructor would then review the theory with the individual groups.

Either method or a combination of both can be used. The grading of student achievement should be accomplished by the evaluation of work done on projects or experiments, by administering written tests with a minimum of one per unit and by evaluating the students' general progress in the formation of desirable attitudes such as responsibility and co-operation.

Poor management and lack of planning are bound to result in confusion. Therefore the instructor must have a well devised plan, firmly in mind, before attempting to operate a multiple activity laboratory.

In the one or two shop organization this is the only way we can achieve the objectives we have set of providing broad exploratory experiences to all students. It is necessary that each instructor prepare himself to the best of his ability to meet those objectives.

(b) Course Areas

To provide a wide exploratory experience, nine basic areas are to be considered. The basic areas are subdivided into units. There are fifteen units, each from nine to twelve weeks in length. The minimum number of areas that should be covered in a three year junior high school program should be nine. Where equipment and instructors are available as many as thirteen can be taught. Where industrial arts is taught only two years in the junior high school, a minimum of six areas should be taught.

Areas of Study	Units
1. Power Mechanics	one
2. Metals	
- sheet and bench metal	one
- machine shop	one
3. Electricity-Electronics	
- electricity	one
- electronics	one
4. Computor	one
5. Wood - 1 and 2	two
6. Plastics	one
7. Graphic Arts (type setting, printing, silk screen, book binding)	one
8. Graphic Communications (photographs, drafting, blue print reading)	one
9. Industrial Crafts (only two units to be chosen)	
- ceramics	one
- art metal	one
- leather	one
- lapidary	one
9 areas	15 units

In addition to the nine units listed above, the junior high school industrial arts program includes a testing area and an instructional materials center. The testing area utilizes the materials and some of the projects made in the other areas. The instructional materials center is used as a students' resource room, conference room and research area.

(c) Length of the Program

The recommended minimum is four periods per week based on a forty week school year. The length of a shop period should be not less than a double period at one time.

There is a total of fifteen individual units excluding the testing section which is part of all of them. To benefit most from the program it should start in Grade VII and continue through Grade IX.

The minimum number of units to be taught each year is three with a maximum of five or as determined by the instructor and the time available. By the end of three years in junior high school a student should have covered from nine to thirteen units. If a three year program can not be instituted, the most representative units of productive industry should be chosen and taught in Grades VIII and IX.

(d) Organization and Design of Industrial Arts Areas

The industrial arts area is designed as a multiple-activity laboratory. It is desired that as many areas as possible be contained within one room and that each of the areas be self-contained with regard to tools, machines and materials. An area which is planned to accommodate four to six students is recommended. These small groups would work in the different areas, e.g. four students would work in the sheet metal area, another four in woodwork and yet another four in electricity. Following the completion of required learning experiences in an area, the group proceeds to the next area. This system of rotation insures each student an introduction to all the components of the program.

A multiple-activity laboratory affords each student the opportunity to observe the interdependence of technologies and to visualize the basic tools, machines, and processes in each of the technologies. When more laboratories are available the number of units taught in each can be correspondingly reduced.

(e) Approach

The use of the project in industrial arts has merit. It is to be considered a vehicle for learning and nothing more. When the project becomes the focal point and ceases to be a media for this learning experience it should be discontinued. Carefully selected projects are recommended for some of the units included in this program. The woods, metal, plastics, and leather lend themselves well to the project method. The projects however should be predesigned and permit a measure of successful achievement for all levels of learning. Many of the units such as electricity, electronics, computer technology, and power mechanics,

lend themselves well to an experimental approach. Pre-designed and programmed laboratory exercises will assist in the degree of student understandings. The instructor should have available operation sheets, related information sheets, and job sheets. These would help him and his students or organize their time efficiently.

Test-stand experiments will assist both in the understanding of these areas and in developing an appreciation for the scientific method.

(f) Suggested Organization of Teaching Units

Grade VII	Grade VIII	Grade IX
Graphic Arts	Wood	Electronics
Plastics	Electricity	Power Mechanics
Leather	Graphic Communications	Computer
Ceramics	Sheet Metal and Bench Metal	Machine Shop

(g) Transition to the Revised Program

Starting from the units presently equipped for in 1964-65 and adding several units per year, the total program can be gradually built up.

Have 1964-65	Add in 1965-66	Add in 1966-67	1967-68
Wood (1)	Electronics	Graphic Arts	Computer
Metal (bench & sheet)	Power Mechanics	Plastics	Industrial Crafts
Electricity			
Graphic Communications (Drafting & Blue Print reading)	Material testing equipment added continuously.		

In a single industrial arts laboratory it is recommended that the nine basic areas be set up. Some of the units can be carried on in the same area by a different class. For example the electricity and electronics would utilize the same area and some of the same equipment.

In a double laboratory set up, the two shops can divide the areas between them. E.g. one laboratory could be used for wood, electricity, electronics, industrial crafts and computer, while the other be set up for metal, power mechanics, plastics, graphic arts and graphic communications.

The planning of the areas or bays should be such that the benches are moveable. This provides for versatility because it makes rearrangement possible. The design of the benches will be such that areas can be made independent of each other - (see appendix).

GENERAL INFORMATION

1. Records

Every instructor should keep the following records:

(a) attendance

(b) daily lesson plan

(c) phase plan for the year

(d) record of student achievement (test marks, project rating, etc.)

(e) inventory of equipment and supplies

2. Size of Classes

Courses and accommodation are prepared on the basis of a class size of twenty pupils.

3. Shop Accommodation and Equipment

The type of shop accommodation will vary from one district to another. There are a number of basic features that are recommended for industrial arts laboratories.

(a) that it be located as a wing of or close to the school.

(b) that the multiple activity type organization be used.

(c) that it have an area of 3,000 square feet in a rectangular shape with the ratio of width to length between 1:1 1/2 or 1:2.

(d) that provision be made for the exhausting of welding, power mechanics and painting areas. A dust collector system should be provided in the woodworking area.

(e) that a concrete floor be used in the metals and power mechanics area with a wood or tile floor in the remaining area.

(f) that there be a master electrical control switch for power outlets, within easy access of the instructor.

(g) that power channels be provided in the floor to allow for flexibility in equipment location.

(h) that an area closed off with glass be provided for the areas of graphic arts and communications.

(i) that adequate storage facilities be provided for materials, tools and projects.

(j) that enough equipment be purchased for a multiple activity shop for six students in each area.

(k) that provision for tool storage be provided in each area.

(l) that unless for specific reasons, open faced tool panels be used. Tools must be available to all students for maximum efficiency.

4. School Opening

Several days to a week should be spent at the school preparing the program prior to opening day. The following points should be attended to:

(a) check the inventory - all tools should be repaired, sharpened, and properly stored.

(b) check materials on hand - there should be material on hand to get the class started the first day.

(c) plan your year's program - prepare a broad outline of the year's work in each grade. Have dates set for the time of rotation, when the groups change their activities.

(d) have the lessons in each area outlined with information and job sheets available to get started.

(e) have the projects selected in each area they are required.

(f) have the record system prepared.

(g) survey project storage space and have lockers assigned by classes. Specific student names given to lockers later.

(h) have a general information sheet prepared for each student outlining general shop procedures and rules, fees required, evaluation criteria, and other information you find pertinent.

(i) if your system has a book-rental scheme, make arrangements to have the initial shop fee collected by the book-rental secretary. You collect the total sum from him later.

(j) have the shop thoroughly cleaned up, painting done when needed, shop coats and aprons clean.

5. Shop Closing

At the end of the school year the instructor must ensure that:

(a) the inventory is checked and reported to the Principal or Secretary-Treasurer.

(b) the students' accounts are audited by a responsible authority, usually the Principal.

(c) the tools are sharpened and needed repairs are ordered.

(d) the tools are either oiled or waxed and put in a secure location.

(e) the shop is thoroughly cleaned and left in creditable condition.

(f) the materials that will be needed in the first quarter of the next term be ordered.

(g) an inventory of job and information sheets is taken and prepare enough to get started in the fall.

(h) rag bins and paint room supplies are checked. Discard all soiled rags.

(i) batteries are removed from electronic equipment meters, etc.

(j) student lockers are cleaned out.

6. Girls

The industrial arts course is a suitable and desirable exploratory course for girls. If it is possible for the girls to be grouped together they may work through the phases just as do the boys.

7. A separate list of films on industrial arts courses is available from the Audio-Visual Aids Branch Department of Education. These films are listed under subject areas to make selection for a specific topic easy.

The Shop Safety Program

Every shop must have an effective safety program. This does not mean that the promulgation of a set of rules and regulations will satisfy this end. Students must be taught in each and every subject studied within the industrial arts framework, the "hows and whys" inherent in the safety program. It is the responsibility of the instructor to supply continuous and vigilant supervision and to ensure that all students engage in only safe shop practices. A good safety program would include:

1. regular and thorough instruction and revision.

2. constant vigilance.

3. checking and evaluating of student safety habits by the instructor.

4. complete first aid equipment kept in first-class condition.

5. non-skid paint and clearly marked working areas around all machinery.

6. proper clothing with particular attention to eye protection.

7. machines and tools in good working condition.

8. routine reporting of all accidents.

9. good housekeeping.

The following is a sample of safety regulations which the instructor might be expected to enforce:

1. No power machines shall be used by any student before specific instruction has been given with regard to safe operation and safety precautions.

2. No power machine shall be used while the instructor is absent from the shop.

3. No machine shall be used by any student unless adequately guarded.

4. Approved eye protection must be worn for certain operations.

Note: A good safety slogan which should be put into practice at all times - a place for everything and everything in its place.

There are five basic steps in safety education:

1. Set a good safety example for students.

2. Instruct each student thoroughly in the safety precautions of his job.

3. Keep all tools sharp and in good condition.

4. Keep all safety devices in proper use.

5. Follow up safety instructions constantly. The shop will be as safe as the instructor makes it.

Dress and deportment play an important part in the operation of a safe shop program. Students and instructor should be neatly dressed at all times and the instructor should take care to ensure that no loose and dangerous clothing is worn. Safety aprons, goggles, gloves, should be used wherever necessary.

It should be pointed out that failure to comply with every reasonable safety precaution, may jeopardize the instructor's position in any claim for compensation. Each school should receive the excellent publications and bulletins dealing with accident prevention and safety procedures distributed by the Workmen's Compensation Board.

Note: Accidents must be promptly reported to some senior school authority. If no other person is designated, this authority is the Principal.

HOW TO USE THIS GUIDE

Each unit is outlined in uniform manner. The "do" operations appear in the left hand column. A student should have performed the majority of these activities in the time allotted to the unit. As there is enough content to require 12 weeks of work, some of it will have to be deleted when taught for a shorter period.

The "know" column is on the right hand side. The student should know the information related to the "do" operations as well as general knowledge about the area. This would include occupational and industrial information, safety precautions and the interdependence of one technology with the others.

The operations are numbered to relate to the information column. The topics are listed in a logical teaching sequence.

Reference books are listed following the course. These are listed in order of suitability and usefulness.

A special list of audio-visual aids is available where films are listed under course headings. Some material is useful under several topics and will appear there.

A Method of Procedure

1. Study the unit you are developing. Read the material in the reference books and manuals. Then develop about ten lessons in logical order that will cover the content in the "know" column.

2. Develop a series of demonstrations that will reinforce and become part of your lessons.

3. Pick out audio-visual materials, films, filmstrips, charts, etc. that can be used with your lesson material.

4. Develop an information sheet on each formal lesson. This is given to the student and contains the "gist" of the lesson. An exercise sheet can be prepared to follow the information sheet which the student does for homework. The exercise sheet consists of a series of questions to force the student to recall the information given in the lesson. The exercise questions should be based on the information sheet. Short-answer type questions can be used. These exercises should be checked by the teacher or used as a quick review.

5. Develop projects, experiments, or exercises based on the "do" operations Write out procedure sheets from which the student works.

6. Next prepare the materials needed by the students to carry out their work. Have all materials needed on hand. With a predesigned project this can be done. Material can be precut to rough size and the package handed to the student. This will eliminate a waste of both time and material.

7. Prepare a system of check points. Prepare quizzes, tests, and progress charts to evaluate mastery of content and work accomplished.

8. Plan a personnel system that places responsibility for tools, clean-up, etc. on the students.

9. Prepare your plan for the year. Define the units to be taught in each grade. Set dates for rotation.

10. List the lesson topics planned for each unit.

11. Prepare a daily record book and list all lesson topics to be covered a week ahead of time.

12. You are prepared. You can now enjoy the excitement of "teaching".

ELECTRICITY

Introduction

Automation, which is producing more leisure time as well as a higher standard of living for us and space exploration which satisfies man's thirst for probing the unknown would not be possible were it not for the extensive use of electrical energy in our present day society. This use is not confined to urban centres alone. It is playing an increasing role in all rural areas as well. In all industries or occupations, some knowledge of electricity will be beneficial. Therefore, it is felt that we can no longer neglect providing students in the junior high school with exploratory experiences in electricity which will help them interpret a productive society, reinforce and synthesize the academic disciplines and serve as a measure of guidance to the students in planning for their future.

As much activity and experimentation as possible must be provided in each unit but these should not be just "busy work". Construction of projects which require a great deal of time but illustrates possibly only one electrical principle should be avoided. Rather, the activities should be such that an optimal amount of electrical principles are involved.

Specific Objectives

1. To develop interest in electrical systems and thus enable students to recognize the importance of these in modern living.

2. To develop an understanding of basic electrical principles and thus remove the air of mystery regarding electricity.

3. To acquaint students with electrical testing equipment.

4. To acquaint students with electrical symbols and diagrams.

5. To help students recognize the vastness of the field of electricity, and the possibilities for further training in these fields in vocational and technical schools.

6. To develop safety habits in working with electricity.

Suggested Procedure

In a multiple-activity program the student must be able to do a considerable amount of work by following written or printed instructions. It is essential that related information, experiments, and instruction sheets which are given to the student be clearly written. It is also essentia that suitable check points be written into the program so that students' progress can be quickl evaluated before he proceeds from one job to another. Experiments should have well directed questions written into them so that the student is sure to make the proper observations and draw proper conclusions.

Course Content

What the student should be able to:

Do	Know
1. View appropriate films or film strips covering this aspect or do research using reference books.	1. Uses of Electricity a. in the home b. in communications c. in transportation d. in construction e. in manufacturing f. in medicine
	2. The meaning of Energy and Power.
3. Experiments where electricity is produced by each of the sources outlined.	3. Sources of Electricity a. generators b. chemical cells c. solar cells and photo-tubes d. heat e. pressure and vibration f. friction g. bio-electricity - developed in the bodies of humans and animals.
4. Research The experiment connecting a simple circuit, using an EMF, a load, and a switch.	4. The use of conductors and insulators.

5. Connect various types of circuits.	5. (a) What is Electricity? - The electron theory (b) Circuitry i. simple circuit ii. series circuit iii. parallel circuit iv. voltage drops v. using a variable resister vi. various types of EMF vii. circuit breaker
6. Make current, voltage, and resistance measurements.	6. Measurements of Voltage, Current, and Resistance.
7. Problems involving the circuits make up.	7. Simple application of Ohm's Law.
8. Perform experiments with magnets. Test materials for magnetic properties.	8. Magnetism a. magnetic field b. laws of attraction and rep. c. use of magnets
9. Experiment to show generator action.	9. Electro-magnetic Induction - Generator
	10. The workings of the simple Electric Motor
11. Experiment with pre-wound used to demonstrate transformer principle.	11. The working of the transformer
12. Measure output of transformer.	
	13. Safety in Electricity

Bibliography

1. Gerrish Howard H., Electricity, Goodheart-Willcox Co., Inc., Chicago, Illinois.

2. Buban and Schmitt, Understanding Electricity and Electronics, McGraw-Hill Book Co., Toronto, Ont.

3. Van Valkenburgh, Mooger and Neville, Inc. Basic Electricity, John F. Rider Publisher Inc.

4. Groneman & Feirer - General Shop (3rd Ed. 1963) McGraw Hill.

5. Joseph P. Arnold and Kenneth L. Schank, Exploring Electricity, McKnight and McKnight Publishing Co., Bloomington, Illinois.

6. E. W. Jones, General Electricity, McKnight and McKnight Publishing Co., Bloomington, Illinois.

7. Smith Mott Matson, A Course in the Fundamentals of Electricity, Westinghouse Electric and Manufacturing Co., Inc.

8. Cook, R. Sherman, Electrical Things Boys Like To Make, Bruce Publishing Co., Milwaukee.

9. C. E. Matson, 30 Instructional Units in Basic Electricity, McKnight and McKnight Publishing Co., Bloomington, Illinois.

ELECTRONICS

Introduction

Electronics is that part of the total field of electricity which deals with the vacuum tube, the transistor, and the circuitry associated with these. Because of automation, the increased use of computers, space exploration, and improved communication systems, electronics has become more and more important in our present day society. In an exploratory course such as this, it would be impossible to cover all phases of electronics in detail or to study the circuitry and components involved in detail. To study only some of these, however, would defeat the purpose of the course which should be in keeping with the general objectives of the Industrial Arts Program. Therefore, an attempt is being made to give the students as much breadth of exploration as possible. A broad selection of systems should be used and their applications in our society emphasized. To do this the student should be given the overall story of the operation of each system first, and then he should study the various sections that comprise the system. Study of components and detailed circuitry should be done only as time permits and student ability indicates.

Specific Objectives

1. To acquaint the student with as many types of electronic systems or equipment as possible.

2. To teach the student the operating principles of these systems and the functions of the sections making them up.

3. To relate to the student the uses of these systems in our society.

4. To teach the student how tubes amplify, how A.C. current is rectified, what radio waves are, how transmitters work, how speakers and microphones work, how photo-tubes work, how time-delay circuits work, etc.

5. To give the student an opportunity to discover his ability to understand electronics and therefore make this field more meaningful to him upon entering a high school or technical school.

Suggested Procedure

The method of teaching the electronic systems will depend to some extent upon the equipment used. In some cases systems such as radio receivers,

amplifiers, etc. can be bought in units which can be put together in various combinations. The approach in such cases would be the assembly of the units into a system. After the assembly, the various units would be taught by the instructor or read about by the student. Various experiments could also be run on this equipment. For example the power supply filter could be removed to show what its purpose is in the system. In other cases the systems would be complete so that no assembly would be possible and a different approach to the experimentation would have to be taken. The related information given to the students, should point out commercial and/or other applications of all the systems studied. An evaluation by means of a test or tests should be made so that a profile of the students' interests and abilities in the various units of the industrial arts program can be made at the end of the term. Demonstrations and instruction by the teacher will supplement the written exercises and related information sheets.

Course Content

What the student should be able to:

Do	Know
1. List the applications of electronics in our society.	1. The use of electronics in our society. a. in the home b. in industry and business c. on the farm d. for communication e. for automation f. in medicine
2. Read about and list occupations and branches of electronics.	2. The opportunities in electronics.
3. Use a neon bulb and make a rough check on the voltage and frequency in AC and DC circuits.	3. The behaviour of AC and DC circuits.

4. Use a neon bulb and check the effect of a capacitor in an AC and DC circuit.	4. The effect of capacitance in circuits - AC and DC.
5. Use a neon voltage test to check the effect of resistance on voltage.	5. The effect of resistance in circuits.
6. Draw a simple diagram of a carbon microphone circuit. Prepare a short talk on how a crystal microphone works. Use an oscilloscope to illustrate this.	6. How microphones work, crystal and carbon.
7. Closely observe the actions of a speaker on a radio receiver or amplifier. Be prepared to explain how the speaker works, or write a short paragraph on its action.	7. How a PM speaker works.
8. Hook up a suitable circuit to illustrate this.	8. The effects of a diode in a circuit, on current flow.
9. Use an available power supply and oscilloscope, check the AC wave form, the pulsating DC wave form, and the filtered wave DC voltage.	9. How a power supply works - type used in receivers, amplifiers, etc.
10. Illustrate this by using an oscilloscope.	10. How amplification takes place.
11. Hook up an oscilloscope circuit as permitted by available equipment.	11. How an oscilloscope works.
12. Broadcast music from a record player with a phono-oscillator and receive it on a receiver.	12. How radio waves are sent into space.
13. Make a block diagram of the turntable, voltage amplifier, power amplifier, speaker, and the power supply.	13. How a record player works.
14. Make a block diagram of the sections, making it up. Use an oscilloscope in the various sections to show the amplification of the signal.	14. How an amplifier works.

15. Make a block diagram of radio receiver.	15. How a receiver works.
16. Hook up a photo cell relay and observe its operation.	16. How a photo cell works.
17. Hook up a time delay relay and be prepared to explain its operation.	17. How a time delay relay works.
18. Hook up a circuit using a photo-tube, a neon lamp, and a capacitor to measure the intensity of light. Also use an available light meter to measure the intensity of light.	18. How light intensity is measured.
19. Make a simple printed circuit for a crystal tuner.	19. What printed circuits are.

Bibliography

1. Evans-Porter, Experimental Basic Electronics, McKnight and McKnight Publishing Co., Bloomington, Illinois.

2. Gerrish Howard M., Electronics, Goodheart-Willcox Co., Inc., Chicago. 1961.

3. Buban and Schmitt, Understanding Electricity and Electronics, McGraw-Hill Publications.

4. University of the State of New York, the State Education Department, Albany, Electronics, Project Ideas.

5. Grob, Bernard, Basic Electronics, New York City, McGraw-Hill Book Co., Inc.

6. Schrader, Robert L., Electronic Communications, New York City, McGraw-Hill Book Co., Inc.

7. Van Valkenburgh, Nooger and Neville, Inc., Basic Electronics, New York City, John F. Rider Publisher, Inc.

WOODWORK

Introduction

Woodwork is one of the most satisfactory mediums in which to express oneself. Although many other materials are used as a substitute, wood is a living material with warmth, texture and beauty, and no other material embodies all the fine qualities of wood.

With the advancement of the technologies and the growth of our country, the skills of the woodworker have found an ever-widening field in all branches of construction. Canada's largest industry is building and the woodworker is the backbone of this industry.

(1) Woodwork in a multiple-type program.

Several projects should be assigned to this area of instruction designed to give the student, in the time available, the optimum of experiences with tools, machines and materials. Quality rather than quantity is stressed. The student is expected to work steadily following complete written instructions prepared by the instructor for the projects. The instructor will demonstrate machines and operations to the group as the need arises.

(2) Safety.

The shop organized for a multiple program must have an effective safety program. Adequate guards on machines; students properly clothed for their work; thorough instruction on the use of all hand tools and power machines. No machine should be student operated until complete instructions have been covered by the teacher.

General Objectives

1. To acquaint the student with common hand tools and basic power tools in the woodwork industry.

2. To enable the student to understand some of the working properties of common domestic and foreign woods.

Specific Objectives

1. To provide an opportunity for students to discover special aptitudes in woodworking.

2. To further the student's understanding of drawings and his ability to interpret them.

3. To develop to some degree the student's manipulative dexterity in the safe handling of tools, machines and materials.

4. To instill in the student an appreciation of high standards and pride in workmanship.

Course Content

What the student should be able to:

Do	Know
1. Measure distances.	1. System of measurement.
2. Take an inside measurement.	2. Kinds of measuring tools.
3. Take an outside measurement.	
4. Form a straight line between two points.	4. Layout tools; types, sizes.
5. Set a marking gauge.	
6. Gauge a line with a marking gauge.	
7. Use a finger gauge.	
8. Gauge with pencil and ruler.	
9. Use a try square.	
10. Use a combination square.	
11. Lay out rounded corners.	
12. Divide a board into a number of equal parts with a ruler.	

13. Test for straightness of a surface.	13. How to select and care for testing tools.
14. Test for squareness.	
15. Cut with a crosscut saw.	15. How to select and care for sawing tools (crosscut, rip, keyhole, coping, back).
16. Cut with a ripsaw.	
17. Cut with a backsaw.	
18. Disassemble a jack plane.	18. How to select and care for bench planes.
19. Assemble the double plane iron.	
20. Adjust the plane for depth of cut.	
21. Adjust the plane iron laterally.	
22. Plane faces.	
23. Plane an edge.	
24. Plane an end.	
25. Square a board.	
26. Plane a chamfer.	
27. Plane a bevel.	
28. Whet a plane iron.	
29. Adjust a rabbet plane.	29. Kinds of special planes.
30. Make a paring cut with a wood chisel.	30. How to select and care for edge cutting tools.
31. Whet a chisel.	
32. Mark with a marking knife.	
33. Insert a bit in a brace.	33. How to select and care for boring tools.
34. Bore vertical and horizontal holes.	
35. Bore a hole to a depth.	

36.	Drill holes with a hand drill.	
37.	Face nail.	37. How to select and apply fasteners (such as nails, screws, etc.)
38.	Set a nail.	
39.	Clinch a nail.	
40.	Nail into end grain.	
41.	Withdraw a nail with a hammer.	
42.	Drive a screw.	
43.	Withdraw a screw.	
44.	Apply glue.	44. Common types of glues and adhesives.
45.	Clamp board.	
46.	Insert a file in a wood handle.	46. Select smoothing tools.
47.	Care for wood files.	
48.	Cut and fold abrasive papers.	48. Types of coated abrasives and how to select them.
49.	Sand-paper flat surfaces.	
50.	Prepare a surface for finishing.	50. Common wood finishes.
51.	Apply an oil finish.	
52.	Brush a finish.	
53.	Polish a finished surface.	
54.	Install sabre saw blades.	54. Care and characteristics of sabre saws.
55.	Operate the sabre saw.	
56.	Cut plywoods.	
57.	Select and check twist drills.	57. How to select and care for electric hand drills.
58.	Correctly drill with electric drill.	
59.	Rip with the bandsaw.	59. Safe care and upkeep of bandsaw.

60. Cross cut with the bandsaw.

61. Cut angles on the bandsaw.

62. Adjust fence and guard on bandsaw.

63. Mount stock for face plate turning.

63. Safe care, operation, and upkeep of wood lathe.

64. Cut with wood turning chisels.

65. Sand on the lathe.

66. Mark out patterns for turning.

67. Apply finishes on the lathe.

68. Polish lathe projects.

NOTE: Any desired selection of operations to complete the selected project and compliment the established objectives may be chosen for Unit 1, Woodwork. The remaining operations, not used in Unit 1, should be included in the work contained under Unit 2, Woodwork.

References

1. General Shop - Groneman and Feirer, McGraw Hill Publications.

2. Hand Woodworking Tools - L. P. McDonnell, Delmar Publishers, Inc.

3. Portable Power Tools - L. P. McDonnell, Delmar Publishers, Inc.

4. Woodworking Technology - Hammond, Donnelly, Harrod, Rayner. McKnight and McKnight.

5. Woodworking Fundamentals - Wolansky, McGraw Hill Publications.

6. Industrial Arts for the General Shop - D. W. Olson.

7. Modern Wood Finishing - R. G. Waring, The Bruce Publishing Company.

8. Getting the Most Out of Your Bandsaw - Deltacraft Publication.

9. Getting the Most Out of Your Lathe - Deltacraft Publication.

10. Getting the Most Out of Your Circular Saw and Jointer - Deltacraft Publication.

GRAPHIC COMMUNICATIONS

Introduction

Graphic communications refers to that type of communication which is written, printed, photographed, silk screened, engraved, inscribed, drawn or painted in order to appeal to the eye for communication purposes. This area, in its broad meaning, would include more than is possible to cover in the junior high school multiple-activity program. To be more specific, graphic communications includes:

- Writing
- Printing, including typing
- Drafting
- Blueprint Reading
- Silk Screening
- Photostats
- Microfilming
- Photography
- Blueprinting
- Blue-Line Printing
- Black and White and Color-Line Prints
- The Ozalid Process
- Line Etching
- Mimeographing
- Hectographing
- Lithography
- Other Processes - new ones are appearing

It is obvious that all of these cannot be covered, therefore one is faced with the task of selecting those which will provide the student with the most worthwhile experiences in keeping with the general objectives of industrial arts.

When one considers how much our modern society depends on graphic communications, it cannot be denied that a large portion of our industries employing thousands of people are concerned with this type of communication.

Specific Objectives

1. To impress upon the student the possibilities of a vocation in the field of graphic communications.

2. To introduce the student to mechanical drawing and point out to him the importance of drafting as the "universal language" of industry.

3. To teach the student elementary blueprint reading.

4. To expose the students to as many processes of reproducing drawings and printed material as possible.

5. To introduce the student to photography. This should also include developing, enlarging and contact printing.

6. To introduce the student to any other phase of graphic communications for which the instructor has facilities and in which he is particularly skilful.

Selection and Analysis of Course Content

A typical selection of content to be explored in this area might be as follows:

- Drafting
- Blueprinting
- Blueprint Reading
- The Ozalid Process
- Hectographing and/or mimeographing
- Photography

Drafting

Drawing was the first graphic communication developed by man. The first symbols to represent sound were developed from simplified drawings. Simple drawing or sketching is used extensively even today to convey ideas, especially when they are of a technical nature.

Drafting is a mechanical drawing done with the aid of tools or instruments. It is used to put into pictorial form instructions for putting together manufactured articles and construction projects. It is done the same way throughout the world, thus being a "universal language". The student should be introduced to this language and the tools used in it.

Course Content

What the student should be able to:

Do	Know
	Drafting
	1. The names and uses of the: a. drawing board b. T square c. 45 set square d. 30-60 set square
2. Set up material for drafting.	2. Methods of fastening paper to a drawing board.
	3. Method of laying out a drawing.
4. Simple orthographic drawing.	
5. Simple isometric drawing.	

6. Dimension drawings.	6. Various methods of dimensioning a drawing operation.
7. Procedure of putting in a title and other pertinent information. (Neat printing using the single stroke, upper case letters in Gothic.)	
	8. The names and uses of such conventional lines as: a. border lines b. construction lines c. outline lines d. dimension lines e. extension lines f. hidden lines
9. Tracings of drawings.	9. Techniques of tracing.
10. Blueprinting and ozalid printing and a mimeograph or hectograph print.	10. Reproduction of drawings.

Blueprint Reading

1. Obtain the necessary information from a blueprint.	1. How to interpret a variety of mechanical drawings as to measurements, material, finishes, drilling and threading, etc.
2. Do exercises which have isometric and orthographic drawings in them.	2. The relationship between an isometric and an orthographic drawing.
	3. Abbreviations used on drawings.
4. Use tables from exercise book to interpret blueprints.	4. How to interpret tables in exercise book pertinent to the reading of blueprints.

Photography

1. Take pictures with a box camera.	1. The camera and its essential features and components such as the lens, the lens opening, the shutter, etc. Methods of how to take effective, artistic pictures.

2. Use of refinements and accessories.	2. Use of accessories or refinements such as a light meter, range finder, flash attachment should be explained
	3. Films - glass plates and flexible film.
	4. Film characteristics: a. speed b. graininess c. color sensitivity
	5. Paper characteristics.
	6. The Dark Room: a. general equipment b. materials and equipment for negative and paper development. c. material and equipment for printing and enlarging.
7. Develop films.	7. Film development.
8. Develop paper prints and enlargements.	8. Paper development.
9. Print from negatives.	9. Contact printing.
10. Enlarge pictures.	10. Enlarging.

References

1. Blueprint Reading:

   a. Lightle, Blueprint Reading and Sketching, McKnight and McKnight Publishing Company, Bloomington, Illinois.

   b. Steinke, Blueprint Reading, Checking and Testing - Part 1 and 2, McKnight and McKnight Publishing Company, Bloomington, Illinois.

   c. Thomas Diamond, Primer of Blueprint Reading, Bruce Publishing Company, Chicago 6, Illinois.

   d. Wyatt, Edwin M., Blueprint Reading, Bruce Publishing Company, Bloomington, Illinois.

2. Drafting:

   a. Ermeling, W. W., Mechanical Drawing, First Year.

   b. Cobaugh, H. B., Shop Drawing for Beginners.

   c. Shaeffer, Glenn N., Basic Mechanical Drawing.

      All of the above are available from:

      Bruce Publishing Company,
      Chicago 6, Illinois.

   d. Introduction to Applied Drawing, General Publishing, 200 Adelaide Street West, Toronto, Ontario.

3. Photography:

   a. McCoy, Robert A., Practical Photography, McKnight and McKnight Publishing Company, Bloomington, Illinois.

GRAPHIC ARTS

Introduction

For thousands of years man has been putting down his thoughts in pictures and adding words; today newspapers, magazines and books provide this kind of communication. In fact, pulp and paper is one of the largest products manufactured in Canada at present. Since printing and publishing materials is a leading industry in Canada the graphic arts section of Industrial Arts assumes considerable importance to students. In this course they should become acquainted with the operations connected with printing and publishing.

Scope

The objective of including Graphic Arts is to provide the students with an exposure to the use of some printing equipment and materials and to relate these to the printing industry.

A. History

(a) the origin and development of letters.

(b) The development of the alphabet.

(c) materials and processes used in making early records.

(d) Medieval recording.

(e) invention of movable type.

(f) invention of slug casting composing machines.

(g) processes and machines - their development and effects on civilization.

B. Importance of the Graphic Arts Industry

to home, industry, communications and transportation.

(a) economic

(b) employment

(c) products

(d) our dependency on it

C. Processes and Equipment

(a) the old vs the new

(b) raw materials into usable materials

(c) hand tools - operations and skills

(d) machine tools - operations and skills

D. Guidance

(a) Employment possibilities: with regard to types of jobs, working conditions, wages and hours, apprenticeship physical and mental requirements, health and safety.

(b) Consumer value: appreciation of commercial printing; labor unions, skilled, semi-skilled and unskilled labor.

At least 9 - 12 predesigned projects complete with detailed job sheets are necessary for a 10 - 12 week period in Graphic Arts. The students progress at their own individual speeds. Some may complete all the projects while others may only do 5 or 6 of them. The students should experience the following processes in the Industrial Arts General Shop.

Course Content

What the student should:

Do	Know
1. Compare type of different sizes and faces.	1. The layout of the California Job case.
2. Set and hold job stick properly.	2. The parts of monotype: face, necks, body.
3. Assemble the type in the job stick.	3. The definition of Linotype - machines used.

4. [illegible] of type and correct errors.

5. [illegible]r a line of type.

6. Justify a line.

6. How to Justify
   - flash left
   - flash right
   - centering

7. [illegible]move type from a job stick.

8. Tie a job in the galley.

9. Make a proof.

10. Make corrections.

11. Lock up in a chase.

12. Ink the press.

12. How to select the right ink - main kinds used today.

13. Set gauge pins.

13. How paper is made - kinds on the market.

14. Run the letter press.

14. The different presses.
   - platen
   - cylinder
   - type - revolving cylinder
   - web fed rotary
   - offset

15. Clean the type, rollers and ink plate.

16. Re-distribute the type.

17. Make a matrix for a rubber stamp.

18. Make a rubber stamp.

18. Process of rubber-stamp making.

19. Set the keepers on the letterpress.

20. Make a note pad with padding cement.

21. Set up letters on a show card printer.

22. Ink the plate and use a brayer.

23. Operate the show card printer.

24. Clean the type, brayer and plate.

Evaluation and Testing

Tests should be administered at regular intervals (at the end of the sixth and twelfth week) to emphasize the printing and publishing industry. The students should have a general knowledge of the materials, processes, and jobs involved without getting into too much detail on particular tools and machines in the shop.

References

1. General Printing, G. U. Cleeton, C. W. Pitkin, and R. L. Cornwell, McKnight & McKnight Publishing Company, 1963.

2. The Practice of Printing, Ralph W. Polk, Chas. A. Bennett Co., Inc., 1964.

3. Printing: A Practical Introduction to the Graphic Arts, H. E. Jackson, McGraw-Hill Book Company, Inc.. 1957.

4. Printing and Allied Graphic Arts, C. W. Hague, The Bruce Publishing Company, 1957.

5. Graphic Arts, Darvey E. Carlsen, Chas. A. Bennett Co. Inc., 1958.

6. Silk Screen Printing, Eisenberg and Kafka, General Publishing Co., Ltd., 1957.

7. Suggested Related Information for the Printing Area -

   Comprehensive General Shop Course:
   Bureau of Industrial Arts Education,
   New York State Education Department,
   Albany, New York.

POWER MECHANICS

Introduction

This course is an attempt to develop in the student a knowledge of and appreciation for the sources and application of energy. The use of engines as a power supply has relieved man of much of the drudgery of work.

It is important that all students learn to understand the fundamental involved in changing energy from one form to another and then harnessing it to some useful purpose through mechanical means.

Specific Objectives

1. To acquaint the student with various forms of energy and the units which convert this energy into usable power.
2. To gain knowledge of the utilization, transmission, and control of this power.
3. To familiarize the student with the operations of basic internal combustion engines.
4. To learn the safe use and care of the common tools used in this area.

Scope

This power mechanics course will include the study of the various forms of energy, its transmission and control with the laboratory, and emphasis on common one-cylinder gasoline engines.

Course Content

What the student should be able to:

Do	Know
1. Simple experiments to illustrate the principle of the steam engine, turbine, water wheel, etc.	1. Sources of power - muscular - wind and water - hydro-carbons - nuclear - solar - chemical
2. Read introductions to power in the suggested primary references.	

	3. Engine classification (a) External combustion reciprocal turbine nuclear (b) Internal combustion gasoline diesel jet rocket
4. Disassemble and reassemble cut-away models of one cylinder two stroke and four stroke cycle engines.	4. Design, names of major parts and arrangements of similarities and differences, advantages and disadvantages of two stroke and four stroke cycle engines.
	5. Extent of uses and applications - Common fasteners and applications - Common hand tools, their uses, care and safety
6. Trace fuel flow through engine.	
7. Remove, clean and replace fuel system components.	7. Safety precautions in handling fuel. Fuel refining processes.
8. Trace fuel flow through carburetor.	
9. Disassemble carburetor, identify parts and reassemble.	9. Names and functions of fuel system components.
10. Remove and service air-cleaner.	
11. Adjust idle and high speed fuel mixtures.	
12. Adjust choke.	
	13. Safety regarding operation of moving parts, heat and carbon monoxide.
	14. Principles of science applied in carburetion.
	15. Types of carburetors.
	16. Significance of air-fuel ratios.
	17. Types of air-cleaners.

	18. Functions of air-cleaners.
19. Trace oil flow through pressure lubrication system.	19. Kinds of lubricants.
20. Trace oil path through splash lubrication system.	20. Purposes of lubrication.
21. Trace oil path through oil-mist lubrication system.	
22. Mix fuel and oil for oil-mist lubrication system.	
23. Compare carbon formation in two-stroke and four-stroke cycle engines.	23. Causes of oil contamination.
	24. Function of oil filters.
25. Identify and inspect different types of oil pumps.	25. Types and operation of oil pumps. Operation of oil pressure relief valves.
	26. Principles of science applied by pressure lubricating systems and gauges.
27. Compare various types of bearings and bearing surfaces.	27. Types and purposes of bearings.
28. Remove, clean, adjust and test spark plug.	28. Types of spark plugs.
	29. Functions of spark plugs in ignition timing.
30. Remove, test and replace capacity.	30. Function of capacitor in magneto ignition systems.
31. Test ignition coil windings for short or open circuit.	31. What short or open circuits are.
32. Remove and replace breaker point assembly.	32. Function of breaker points in ignition timing.
33. Adjust gap and ignition timing.	33. Function of breaker point cam in ignition timing.
34. Compare flywheel magneto ignition system with battery system.	

34. Trace manual speed control linkage.	35. Operation of simple machines - lever, pulley, wheel and axle, inclined plane, screw and wedge.
36. Adjust throttle linkage for low and high speed control.	36. Function of throttle in speed control.
37. Trace air-vane governor air path.	37. Name and function of air-vane governor parts.
38. Trace air-vane governor speed control linkage.	38. Principles of science applied by air-vane governor.
39. Remove, examine and replace centrifugal governor.	39. Name and function of centrifugal governor parts.
40. Trace centrifugal governor speed control linkage.	
	41. Principles of science applied by centrifugal governor.
42. Trace source of movement and path of air through air-cooled engine.	42. Principles of science applied by air-cooled systems.
43. If liquid-cooled engine is available, trace path of liquid through the system.	43. Principles of science applied by liquid-cooled systems.
	44. Reasons for rust and scale.
	45. Functions and operation of water pumps.
46. Remove, examine and replace thermostat.	46. Functions and operation of thermostats.
47. Prepare and check anti-freeze solutions.	47. Kinds of anti-freeze solutions.
	48. Freezing points of various liquids.
49. Mock-ups to indicate methods of power transmissions if time permits and as suitable equipment is accumulated.	49. Methods of power transmission (Mechanical advantage, direction change and control) - gears - belts and pulleys, chains and sprock, etc. - fluid couplings and hydraulics - cams and eccentrics - pitmans - splines and shafts - clutches - positive acting, slipping

50. Any additional experiments in power transmission and control, when suitable hydraulic and pneumatic demonstration units become available.

50. Principles of hydraulics and pneumatics, pumps and pistons, orifices, valves, and gauges.

51. When a suitable small engine test stand becomes available the following comparative tests should be performed on small two and four stroke cycle gasoline and diesel engines:
- Fuel consumption tests
- Torque test
- RPM tests
- Thermal efficiency tests

(It is conceivable that with the limited time available for the power mechanics unit, the testing activities outlined above may well replace much of the disassembly and reassembly of live motors and provide for better attainment of the objectives of this course.)

52. Carburetor setting for best air-fuel ratio for best power and performance. Plug selection for the engine. Variations in engine output under varying temperature, humidity and pressure. R.P.M. at which engine produce maximum horsepower.

53. Read guidance information available.

53. Have some knowledge of related fields.

54. Visit suitable local industries.

54. Opportunites for further study of the subject.

55. Discuss the subject with the teacher, guidance personnel and persons in the field.

55. Job opportunities.

References

1. Power Mechanics, P. H. Atterberry, Goodheart-Willcox Co., Inc.

2. Exploring Power Mechanics, H. T. Glenn, Copp Clark Co.

3. General Shop, Groneman and Feirer, McGraw-Hill of Canada Ltd.

4. Understanding America's Industries, Gerbracht and Robinson, McKnight and McKnight

5. Auto Mechanics Fundamentals, Stockel, Goodheart-Willcox Co. Inc.

6. Power Mechanics, Stephenson, Delmar Publishers Inc.

7. Automotive Fundamentals, Nash, McGraw-Hill of Canada Ltd.

8. All About Small Gas Engines, Purvis, Goodheart-Willcox Co., Ltd.

9. ABC's of Hand Tools, Booklet by G.M.C.

10. Power Primer, Booklet by G.M.C.

11. Power Goes to Work, Booklet by G.M.C.

12. Story of Power, Booklet by G.M.C.

13. Diesel-The Modern Power, Booklet by G.M.C.

14. How the Wheels Revolve, Booklet by G.M.C.

15. Transportation Progress, Booklet by G.M.C.

16. General Theories of Operation, Briggs and Stratton, Millwaukee.

17. Evinrude Service Manual, Outboard Marine, Peterborough, Ontario.

18. Push and Pull (Story of Energy), Paul E. Blackwood, McGraw-Hill of Canada Limited.

19. The Boy's Book of Engines, Motors, and Turbines, A. Morgan, C. Scribner and Sons

20. Power Unlimited, A. Marcus, Prentice-Hall of Canada.

PLASTICS

Introduction

This course in plastics will introduce one of the most fascinating areas of science and industry known today.

Every day we see some new and beautiful product made from plastics. Things we never dreamed could be made of plastics a few years ago, are now commonplace - boats, pools, air mattresses, raincoats, galoshes, clothing, and thousands of other products.

Why this sudden popularity of plastics? Scientific developments are the answer. New plastics have been createdwhich are more useful, more beautiful, and cheaper than the materials they have replaced. We all have occasion to use plastics every day. For most of us, it seems safe to say that there is no other type of material which we use so often and about which we know so little.

Specific Objectives

1. To provide the student with some basic experiences with plastics.

2. To acquaint the student with various forms of plastics and some of their characteristics and limitations.

3. To impart an appreciation for plastics as used in the home and community.

4. To develop an appreciation of good design and workmanship in plastic materials.

5. To acquaint the student with some of the methods and processes used in the plastic industry.

Course Content

What the student should be able to:

Do	Know
1. Plan in plastic.	1. (a) Some characteristics of plastics such as thermosetting, thermoplastic, plastic memory, ability to transmit light, etc.
	(b) Common types of plastics such as acrylics, acetates, cellophane, dacron, mylar, nylon, orlon, phenolics, polyethylene, vinyls, etc.
2. Lay out stock.	2. Lay out tools and how to use them for plastics.
3. Cut out stock.	
4. Square up stock.	
5. Form plastic by heat.	5. Various methods of shaping plastics - heat forming, casting, cutting, etc.
6. Join plastic by heat.	6. Methods of joining plastics - welding, cementing, screws, rivets, etc.
7. Join plastic pieces together.	7. Various cementing agents and their uses.
8. Laminate plastic.	
9. Cement plastic.	
10. Sand plastic.	
11. File plastic.	
12. Buff and polish plastic.	
13. Color plastic.	13. How to color plastics.
14. Operate machines which form and shape plastics.	14. Various methods of machining plastics, and the requirements of each.
15. Identify common plastics.	

16.	Administer some tests to common plastics.	16. Various tests for common plastics - heating, odor, burning, solubility, specific gravity, scratch, bending, and flexibility tests.
17.	Cast in plastic.	17. Methods of casting simple forms in plastics.
18.	Decorate the surface of plastic.	18. Methods of using various burrs for surface decoration.
19.	Internal carving in simple shapes.	19. Carving procedures.
20.	Mold by foaming styrene beads.	20. The foaming properties of styrene.
21.	Rotational molding.	21. What "plastisols" are. How to use plastisols for hollow molding as in toys.
22.	Slush molding.	22. How to form "open" projects in plastisol as boats.
23.	Blow forming.	23. The difference between blow forming and vacuum forming.
24.	Vacuum forming.	
25.	Injection molding.	25. The difference between injection and extrusion molding.
26.	Extrusion molding.	
27.	Compression molding.	27. How compression molding is done and used.
28.	Transfer molding.	28. The advantages of transfer molding over compression molding.
29.	Fiberglas repairing.	29. How to apply fiberglas.
		30. How to color fiberglas.

Suggested Projects

1. Zipper pulls	6. Dress clips	11. Candle holders
2. Bag pulls	7. Jewelry	12. Cigarette boxes
3. Blind pulls	8. Tie clasps	13. Jewelry boxes
4. Keychain ornaments	9. Picture frames	14. Bill files
5. Letter openers	10. Bracelets	

For further suggestions, see reference list for books containing projects.

References

1. Adams, John V., Plastic Arts Crafts, D. Van Norstrand Co. Inc., Princeton, New Jersey.

2. Bakelite Corporation, Bakelite Plastics — Cast Resins, Bakelite Corp., 300 Madison Avenue, New York 17, N. Y.

3. Bick, Alexander F., Plastics for Fun, The Bruce Publishing Co., Milwaukee, Wisconsin.

4. Cadillac Plastic Company, How to Work with Plexiglas, Cadillac Plastic Co., 15111 Second Avenue, Detroit 3, Mich.

5. Cherry, Raymond, General Plastics, 1952, McKnight & McKnight, Bloomington, Illinois.

6. Cope, Dwight & Dickey, Floyd, Cope's Plastics Book, 1960, Goodheart Willcox Co. Inc., Chicago, Illinois.

7. De Wick, E.S., & Cooper, J.H., Plastic Craft, 1946, The Macmillan Co., New York, N. Y.

8. Dubois, J.H., Plastics, 1945, The American Technical Society, Chicago, Illinois.

9. Edwards, Lauton, Making Things of Plastic, Chas. A. Bennett Co., Peoria, Illinois.

10. Gottshall, Franklin H., Craftwork in Metal, Wood, Leather, Plastics, The Bruce Publishing Co., Milwaukee, Wis.

11. Groneman, Chris H., Plastics Made Practical, The Bruce Publishing Co., Milwaukee, Wis.

12. Mansperger, Dale E. & Pepper, Carson W., Plastics Problems and Processes, International Textbook Co., Scranton, Pa.

13. Rohm & Haas Company, Working with Plexiglas, 1947, Rohm & Haas Company, Washington Square, Philadelphia 5, Pa.

14. Steele, Gerald L., Fiberglas Projects and Procedures, McKnight & McKnight, Bloomington, Illinois.

15. Whitehead, Art and Erickson, Berk, The Glasser's Manual, Taylor and Art, Inc., Plastics, 1710 East 12th Street, Oakland 6, California.

16. The Lionel Engineering Series, Plastics Engineering Manual, The Lionel Corporation, 15 East 26th Street, New York 10, N. Y.

* Prime References

MACHINE SHOP

Introduction

Metals are an important material to all of us. How new metals are in common use today and articles formerly made of wood are now being made of metal.

This unit will give you some knowledge of metals and how to shape and form them. It will give the student an insight into the many worthwhile careers related to metal working.

Specific Objectives

1. To develop an understanding of the use and importance of machine tools.
2. To develop the necessary skill to use basic machine shop equipment.
3. To develop the ability to plan a job in advance.
4. To learn to work safely and effectively with machine tools.

Course Content

What a student should be able to:

Do	Know
1. Take an outside measurement with calipers.	1. Kinds of measuring tools.
2. Take an inside measurement with calipers.	2. Fractions and decimal equivalents.
3. Take an outside measurement of round stock with a vernier caliper.	
4. Take measurements with a micrometer.	

5. Mark with machinist's ink.	
	6. Lathe operations.
7. Lubricate lathe.	7. Types of lubricating oil.
8. Mount material in chuck.	8. Types of lathe chuck.
9. Turn round stock.	9. Types of cutting tools.
10. Face stock.	10. Cutting speeds and feeds.
11. File on the lathe.	11. Types of lathe files.
12. Polish on lathe.	
13. Knurl.	13. Types and sizes of knurling tools.
14. Center drill stock.	14. Types and sizes of center drills.
15. Turn between centers.	15. Types and sizes of lathe dogs and centers.
16. Clean lathe.	
	17. Shaper operation.
18. Lubricate shaper.	
19. Mount work in chuck.	
20. Machine aluminum.	20. Types of cutting tools, cutting stroke, feed and cutting speed.
21. Clean shaper.	
22. Mount drill in chuck.	22. Drill-press operation.
23. Adjust table height.	
	24. Systems of determining drill sizes, fractional numbers and letters.
25. Adjust spindle speed.	25. Drill speeds and feeds.
26. Secure work to table.	26. What work-holding devices are available.
	27. Safety precautions.

28. Drill hole.

29. Grinder operations.

30. Sharpen a chisel.

31. Use a grinding wheel dresser to clean and tune up a wheel.

References

1. South Bend Lathe Works, How to Run a Lathe, Fraser & Bedell, General Metal, 1962, Prentice-Hall of Canada.

2. Machine Shop Series, Benchwork, Thomas Nelson & Sons, Krar and St. Arnand, Machine Shop Training, 1962, McGraw-Hill Publications.

3. Glazener, L. R., Modern Metalwork, 1954, The Steck Company, Austin, Texas.

SHEET AND BENCH METAL

Introduction

It is important for students to understand the large part that metals play in our modern standard of living. They should know some of the basic methods of forming and shaping this material. This unit will bring the student into contact with the common tools used to form metal and teach him how to use them. A study of occupations related to metalworking will reveal the wide scope of this occupational area.

Specific Objectives

1. To provide the student with an opportunity to discover special aptitudes in metalworking.

2. To provide the student with an opportunity to learn to use metalworking tools safely and correctly.

3. To give the student an insight into the occupational opportunities related to metalwork.

Course Content

What the student should be able to:

Do	Know
Sheet Metal	
1. Measure with a steel rule.	1. Lay-out procedures and tools.
2. Lay out patterns on sheet metal and bar stock using the: - steel rule - steel square - scriber - dividers - trammel points - hermaprodite calipers - marking ink	

	3. Identification of metals: (a) iron (b) aluminum (c) copper (d) brass
4. Use a tinsnip.	4. Selection and care of cutting tools.
5. Use a prick punch.	5. Types of punches - solid and hollow.
6. Center punch for holes.	
7. Use a hollow punch.	
8. Cut metal with a hacksaw.	8. Use of hacksaws - frames - blades
9. Cut metal with a cold chisel.	9. Chisels - types.
10. File surfaces and corners of metal. (a) crossfile (b) drawfile	10. Files - uses, types, cuts, selection.
11. Drill holes with a hand drill.	11. Types of drills - Carbon, Highspeed
12. Drill holes with a drill press.	12. And understand drilling by machine-speed selection, lubricator parts.
13. Countersink a hole.	13. Use and types of countersinks.
14. Make joints, lap, grooved.	14. Fastening methods.
15. Join metals with: - rivets - solder - spot welding (optional) - bolts - self-tapping screws	
16. Form metal with a slip roll.	16. Methods of forming metal.
17. Bend sheet metal in a bar folder, or a box and pan brake.	
18. Bend sheet metal by hand.	18. Use of stakes, forming block.
19. Bend bar stock in bender.	
20. Bend bar stock by hand on anvil, bending pins and vise.	20. Types of hammers, mallets, and their use.

21. Twist bar stock.	21. Heat-treating colors.
22. Temper, anneal, and harden metals.	
	23. Use of vises and their care.
24. Grind a cold chisel and punch.	24. Types of grinders and wheels.
25. Thread with taps and dies.	25. Standard thread forms.
26. Paint with brush and spray.	26. Various finishing methods.
27. Polish surfaces with emery cloth, steel wool, grinding compound and buffer.	
28. Scratch finish a surface.	
29. Pun a surface.	
30. Color by heat-tinting and chemicals.	

References

1. Ludwig, O. A., Metalwork Technology and Practice with Study Guide, 1962 General Publishing Company.

2. Fraser and Bedell, General Metal, 1962, Prentice-Hall of Canada.

3. Groneman and Feirer, General Shop, 1963, McGraw-Hill Publication.

4. Neundorf and Stevens, Sheet Metal Practice - Part I, 1962, McGraw-Hill Publication.

THE ELECTRONIC COMPUTER

Introduction

The development of the electronic computer, the so-called "giant brain", is one of the most remarkable and important developments of this century. It may well be that the computer will eventually bring the more benefit to man than any other modern inventions. The first computer was built in 1946. It was slow and unsatisfactory. Since then vast improvements have been made, particularly because of the use of transistors which are more reliable than vacuum tubes. These improvements helped to diversify the uses of computers. Some of these uses are:

1. Computers for Office Automation

   Governments and business organizations can save many thousands of dollars and also conduct their business more efficiently through the use of computers.

2. Computers in Engineering

   Many of the complex things man is building could never be built with any assurance of success were it not for electronic computers. Multistage rockets, nuclear reactors and many other such projects are too costly to build on an experimental basis. Mistakes made in construction of nuclear machines can be located by placing data on computers which locate errors. Rather than build a real model, an engineer can develop sets of equations to represent the performance of the real model. These equations worked out on computers show the final results quickly.

3. Computers in Science

   Computers were originally built by scientists to help them to calculate rapidly and accurately. For example, astronomers spent most of their lives making calculations; now computers can do these quickly, freeing the scientist for other work.

4. Computers in Automatic Control

We already have many factories which are automatic. Computers are programmed to control the machines according to a pre-arranged plan. This type of control is more efficient than human control. The use of computers for this type of work will vastly increase in the future.

There is no doubt that more uses for computers will be found in the future. Students should be made aware of this growing technological field.

Specific Objectives

1. To develop an understanding of the basic principles of operation of the analog and the digital computers.

2. To impress upon students this new and important technological field and thus guide capable students to determine if their life work might be in this field.

3. To perform a variety of mathematical operations by using computers.

4. To do simple programming on the digital computer.

5. To relate the use of electronic computers to automation, engineering, science, and other data processing.

6. To show the students another important use of electricity.

Suggested Procedure

In a multiple-activity program there would generally be from four to six students working with computers at one time. Analog computers are not as common as digital computers and therefore it is suggested that only about two weeks be spent on these. It is then possible to have only two analog computers. However, there should be one digital computer for each student. Although it is possible to have two students working on one computer, this is not advisable. Students prefer to work alone in this area.

The manuals provided with the computers are generally well written and can be used by the students without too much difficulty. However, a considerable amount of instruction is necessary in order to help students understand what they are doing. The exercises in the manuals can be supplemented by the instructor. Some program writing should be attempted so that the students can gain more knowledge of the circuit work involved. It is suggested that students should be given a short test at the end of each book so that they do not proceed to the next one unless they achieve some understanding of the material already covered. They should also be given a test at the end of their work with computers so that a profile of achievements in the various technologies covered by each student can be made at the end of the term.

Course Content

What the student should be able to:

The Analog Computer

Do	Know
1. Study the circuit of an analog computer.	1. The principle on which analog computers operate.
2. Multiply on a computer.	2. How to multiply numbers using the computer.
3. Divide on a computer.	3. How to divide numbers using the computer.
4. Solve problems using the computer.	4. Methods of working out simple problems involving formulas in which multiplying or dividing is necessary.
	5. Some practical uses of analog computers in the world of today.

It is suggested that about two weeks be spent on this work and the balance of the time on the digital computer.

The Digital Computer

6. The exercises outlined in the computer manual to become familiar with the machine.	6. What components make up the digital computers and what purpose each component serves.
7. Program exercises given in the manual in order to learn the basic computer functions.	7. What a digital computer is. (a) Basic computer functions (b) Some knowledge of commercial equipment.
8. Program operations "And", "Or", "Not"; either but not both. The experiments in the manual which make use of decision making.	8. How computers make logical decisions
9. Binary addition, subtraction, multiplication and division, using the computer.	9. How computers do arithmetic

10. The experiments outlined in the manual. These are simulations of simple computer-like devices in everyday use.	10. The extent of the work computers can do.
11. Program and play games on a computer using it as an opponent or as a referee.	11. How computer games can be played.

The content outlined is of sufficient length and difficulty to challenge the best student. He will succeed according to his ability and interest and the ability and interest the instructor displays.

Reference

Computer Arithmetic, Henry Jacobowitz, John F. Rider Publisher Inc., N. Y.

INDUSTRIAL CRAFTS

Introduction

The student appeal of Industrial Crafts lies in its real life situations and the solution of practical problems. So much of education is theoretical and made up of artificial experiences that to some it becomes distasteful.

In Industrial Crafts, the student finds there are other standards of achievement than those required for mental prowess and he learns to respect these accomplishments in others.

There are four units in Industrial Crafts, namely: ceramics, leather, art metal, and lapidary. No more than two (2) of these should be chosen in the total junior high school program.

CERAMICS

Introduction

The field of ceramics is very extensive since it includes the making and processing of all industrial, commercial, and art work involving the use of clay. In ceramics, pottery has its most popular appeal when treated as a craft, and can be brought close to the commercial product by the use of plaster molds for casting.

In this course, ceramics will be regarded as the shaping or forming of clay into a finished piece of pottery. It will include treating by heat, glazing, and otherwise ornamenting of the project and all the intermediate steps required to produce a finished object of beauty and utility.

The following course may be approached from the creative or craft aspect or from the industrial point of view. Either approach gives a feeling of satisfaction to the student since the results are equally gratifying, and acquaints the student with possibilities for jobs in the manufacturing of ceramics.

Pottery clay from local sources may be used but more uniform results with less disappointments will be experienced if the clay is purchased in a prepared state. Clay may be purchased in a moist state or in powdered form, known as clay flour. The powdered form is recommended since it is not necessary to pay freight charges on water which can be added locally.

Specific Objectives for the Ceramics Area are:

1. To give an appreciation for ceramics as used in modern homes and living as well as in industry.

2. To acquaint the student with some of the basic experiences in handling clay and glazes.

3. To develop appreciation for good design and workmanship in ceramics.

4. To acquaint the student with the various forms of ceramics as used in the home and commercially.

5. To stimulate interest in ceramics as a hobby or leisure time interest as well as a commercial interest.

Course Content

What the student should be able to:

Do	Know
1. Prepare day by wedging.	1. How to fettle greenware.
	2. Purpose of wedging board.
3. Mold a free-form shape in clay.	3. Methods of finishing greenware.
4. Form clay by the ball method.	4. Application of ball-type project.
5. Form clay by the slab method.	5. Application of slab-type project.
	6. Advantages and disadvantages of slab-type work.
7. Form clay by the coil method.	7. Application of coil method.
8. Use the potter's wheel for simple turning.	
9. Finish greenware.	
10. Fire bisque ware.	
11. Apply various glazes.	11. Different ways of applying glazes.
12. Apply over glazes.	
13. Apply under glazes.	
14. Fire glazeware.	
15. Make plaster bats.	15. Purpose of plaster bats.
	16. Storing of materials.
17. Make casting slip.	17. The proper consistency of slip for pouring.
18. Make greenware from slip.	

19. Make one-piece molds.

20. Make simple two-piece molds.

21 Mix plaster of paris for molds.

21. Methods of preparing plaster for molds.

22. What greenware is.

Suggested Projects

1. Bowls
2. Small vases
3. Shallow dishes
4. Salt and pepper shakers
5. Spoon trays
6. Candy dishes
7. Sugar and creamers
8. Figurines
9. Novelties
10. Free-form dishes

References

1. Activities in Ceramics, Thompson, Seeley.
   Excellent student text with general information and techniques. Free-forming, press-forming, and build-up methods are outlined as well as slip casting and the potter's wheel. Glazing, decorating, firing and mold making covered.

2. Arts and Crafts, Ickis, Marguerite.
   Section on pottery. Suggestions for homemade equipment. Simple clay construction methods and casting.

3. Arts and Crafts for Canadian Schools, Shore, Louis A.
   Historical notes. Simple pottery procedures and slip casting.

4. Ceramics Handbook, Hyman, Richard M.
   Covers all the basic ceramic processes. Many illustrations of commercial equipment and directions for making your own equipment.

5. Making Pottery, De Sager, Walter A.
   Good introduction to history of pottery. Picture examples of different types of early ware. Instructional part based on "seeing". Each step and process pictured with short explanations.

6. Pottery and its Making, Thomas, John & Sikes, Mary.
   Good information book. Excellent on history of pottery among early nations. Deals with modern manufacturing methods from informational standpoint.

7. Pottery, Getting Started in Ceramics, Olson, Delmar W.
   Complete book for beginners. How to design, form clay by hand or on the wheel, glaze and decorate. How to fire your own ware and make molds. Where to purchase supplies. Chapter on equipment planning.

8. Pottery Made Easy, Dougherty, John.
Clearly written, easy to follow book covering all essentials and processes that are taught in school ceramics. Each process divided into operations with each step numbered. Well illustrated.

9. The Ceramic Arts, Johnson, W. H. & Newkirk, Louis V.
Very comprehensive book written for use in industrial arts classes. Besides the truly ceramic fields, it includes chapters on alabaster, cement, plastics, and concrete. Very well illustrated. Contains many projects, plans, and ideas.

10. The Potter's Craft, Binns, C. F.
Good on the history, nature and preparation of clay. Covers the potter's wheel, turning and mold making as well as casting, glazing, and firing of clay with a chapter on high-temperature wares.

LEATHER CRAFT

Introduction

Because of decreasing working hours per week, we find ourselves with an increasing amount of spare time per week which can, pleasantly and sometimes profitably, be spent in the development of hobbies and leisure time interests.

To acquaint the student with some of these areas and the possibilities that they offer in the hobby and leisure time field, it is suggested that he be exposed to at least one of the following areas while taking exploratory subjects in the junior high school. It is for this reason that this guide is set up to cover industrial crafts areas that are not touched upon as often as others.

With this in mind the following objectives have been set up specifically for the Industrial Crafts area of industrial arts.

Specific Objectives

1. To familiarize the student with some of the fundamental processes and constructions as used in this media.

2. To develop an appreciation of good design and workmanship as displayed in this media.

Course Content

What the student should be able to:

Do	Know
1. Store, sharpen, and condition tools.	1. Care of tools.
2. Make templates.	
3. Lay out and cut leather.	3. Methods used for laying out and cutting leather.
4. Moisten leather.	4. Preparation of leather for tooling or carving.
5. Transfer designs to leather.	5. Various ways in which to transfer designs to leather.
6. Use Craftaids.	
7. Use swivel knife.	7. Methods of using swivel knife.

8. Tool sequences: a. cutting b. reveling c. background	8. The proper tool sequences.
9. Set stamping.	
10. Use edge creaser.	10. Ways to finish edges properly.
11. Skive leather.	11. The purpose of skiving.
12. Lace using: a. whip stitch b. single buttonhole c. double buttonhole	12. Types of lacing.
13. Wet or dry splicing.	13. Two methods of joining lace.
14. Sew leather.	14. Hand sewing of leather.
15. Cement leather.	15. Current methods of cementing.
16. Use leather punch to make holes.	16. Types of leather punches.
17. Fasten with various fasteners: a. eyelets b. rivets c. snap fasteners	
18. Finish with a. hand rubbing b. liquid wax c. paste wax d. oil	18. Application of finishes.
	19. Correct care of leather articles.
20. Assemble leather projects properly. 21. Clean leather articles.	

Suggested Projects

1. Book marks	9. Axe sheath
2. Comb cases	10. Book covers
3. Key cases	11. Bond cases
4. Wallets or billfolds	12. Pocket secretaries
5. Ladies' wallets	13. Coin purses
6. Luggage tags	14. Belts of various styles
7. Eye glass cases	15. Checkbook covers
8. Knife sheath	16. Small bags or purses

Four projects should be selected by the teacher. The parts of the project can be cut out oversize and placed in an envelope. The student thus has all the parts and can begin work immediately. The student cuts out the pieces to exact size and puts on his own design.

References

1. Cherry-Raymond, General Leathercraft, General Publishers.
2. Zimmerman, Leathercraft, Goodheart-Willcox Co., Inc.
3. Groneman, Leathercraft, Charles A. Bennett Co., Inc.
4. Lucky Seven Foto Carve Book by Craftool Co.
5. Grik, Leathercraft, Book One.
6. Grik, Leathercraft, Book Two.
7. Grik, Leathercraft, Book Three.
8. Al. Stahlman, How To Carve Leather.

ART METAL

Introduction

Art metal work is one of the oldest forms of metal-working. Ancient peoples knew how to work with gold, copper, bronze, silver, and pewter, and made beautiful articles from them. Today making articles from non-ferrous metals is an interesting and rewarding experience.

This unit in art metalwork allows considerable scope in the selection and design of projects. Opportunities are provided for the pupils to use their initiative, experiment, and express creativeness. It will help develop a sense of pride in individual accomplishment.

Specific Objectives

1. To provide an opportunity for the expression of originality and individual initiative.

2. To provide an opportunity to apply the principles of good design to metal.

3. To develop enough skill to complete a satisfactory project.

Course Content

What the student should be able to:

Do	Know
1.	1. The basic principles of good design.
2. Lay out a project using: a. steel rule b. square c. scriber d. dividers	2. The use of layout tools.
3. Transfer a design to metal using: a. tinplate b. carbon paper	3. How to transfer designs to metal.
4. Use tinsnips to cut metal.	4. Methods of cutting metal.
5. Use jeweler's saw.	
6. Use cold chisel.	
7. Use wire cutters.	

8. Use a hand drill to make holes.	8. Methods of making holes.
9. Use hollow punches.	
10. Anneal aluminum.	10. Methods of annealing and pickling art metals.
11. Pickle copper.	
12. Bend metal with: a. stakes and mallet b. metal brake	12. Methods of forming art metals.
13. Twist bar stock on forms and jigs.	13. Twisting methods. 14. Types of stakes. 15. Types of hammers used in forming sheet metal.
16. Form metal by beating down.	
17. Form metal by raising.	
18. Finish edges of metal by: a. flaring b. fleeting c. doming d. crimping e. peening	18. Methods of finishing edges.
19. Decorate metal by: a. planishing b. fleeting c. chasing d. spotting e. stamping f. stipling g. embossing	19. Methods of decorating metal.
20. Use emery cloth, steel wool, and buffing compounds to polish and clean metal.	20. Polishing methods.

References

1. Siegner, C. Vernon, Art Metals (1961), General Publishing Company.

2. Fraser-Bedell, General Metal, (1962), Prentice-Hall Company of Canada.

LAPIDARY

Introduction

Records indicate that man practiced lapidary as early as 5,000 B.C. when the Egyptian Pharoahs used polished rock as ornaments and for ring seals. The Chinese have long been famous for their jade carvings. Many countries are noted for their precious stones which are used in lapidary work. India has rubies, Australia has opal, and Brazil has agate.

Today lapidary is considered to be Canada's fastest growing recreational activity. It can be enjoyed by people of all ages and of both sexes. It is a healthful, relaxing hobby which can involve a lot of varied activity. This includes reading interesting books, making field trips for rock collection, attending rock shows, meeting dozens of people who are also rockhounds and spending many happy hours working with nature's gift of rock and gem material while converting them into objects of usefulness and adornment.

The invention of the diamond-saw blade, improved abrasives and polishing compounds have resulted in a finer finished product which can be completed in record time. The reduced cost of equipmert and improved techniques make it possible for an ever increasing number of people to enjoy the art of lapidary.

Specific Objectives

1. To develop an appreciation of the beauty of nature.
2. To foster an appreciation for fine craftsmanship.
3. To develop manipulative skill.
4. To teach identification of some rocks and minerals.
5. To learn different techniques for polishing rock material.
6. To develop originality in design and pride in accomplishment.
7. To explore a wide avenue which could become a very interesting and satisfying hobby.

Course Content

What the student should be able to:

Do	Know
1. Test rock for hardness using Moh's scale.	1. What makes rocks suitable for polishing and cutting: a. hardness b. color c. pattern d. fracture

2. (a) Cabachon grinding (b) Flat lapping (c) Tumbling (d) Faceting	2. Techniques of polishing and cutting.
3. Cut with combination slab and trim saw.	3. Names and functions of machines.
	4. Proper care of blade.
	5. Use of lubricant.
6. Grind rock to shape.	6. Proper speeds, grit sizes.
	7. Proper care of wheels.
8. Sand and polish stone by machine.	8. Types of sanding discs and belts (wet or dry).
	9. Abrasives.
10. Use a template.	
11. Use a dop stick.	
12. Remove dop stick, clean and fit stone.	
13. Polish rock using cerium oxide and: a. felt b. leather c. muslin d. pellon	13. Polishing methods.
14. Glue stone to finding.	14. Use and kinds of glue, e.g. Epoxy 220 glue.
15. Horizontal lap.	
16. Polish by tumbling.	
17. Faceting.	17. Special technique for fancy ring stones.
18. Search for suitable rocks.	18. Rock hunting areas.

Vocabulary

Lapidary - the art of cutting and polishing rocks.
Lapidarist - one who cuts and polishes rocks.
Rough - rock and gem material as it is found deposited by nature.

Slab - rough material is sawed into slabs, usually about 3/16" thick.
Cabachon - rock is usually ground into this shape for making jewellry; a gently rounded surface with the crown thicker than the edges.
Baroque - a rock of irregular shape, usually polished in a tumbler.
- Baroques may be mounted on key chains, bracelets, etc.
Dop Stick - small dowell or nail cemented to preformed rock to enable easier manipulation of rock for grinding, sanding, and polishing operations.
Rockhound - one who is actively interested in collecting rocks.
Pebble puppy - a young rockhound.

Suggested Projects

1. Earring and pendant sets
2. Rings
3. Cuff link and tie bar sets
4. Brooches
5. Bracelets
6. Key chains
7. Pen stands
8. Bookends

References

* 1. Sinkankas, Gem Cutting, A. Lapidary's Manual, D. Van Norstrand Co., Inc. Princeton, New Jersey, $13.00.

** 2. O'Brien, How to Cut Gems, 1116 North Wilcox Avenue, Hollywood 38, California, $1.10.

3. H.C. Dake, The Agate Book, Minerologist Publishing Co., Portland 14, Oregon, $1.50.

4. Dr. H. C. Dake, The Art of Gem Cutting, Minerologist Publishing Co., Portland 14, Oregon, $2.00.

5. Gem Tumbling and Baroque Jewellery Making, Victor Agate Shop, South 1709 Street, Spokane, Washington, $2.00.

6. Lelande Quick and Hugh Leiper, Gemcraft, Chilton Co., Philadelphia, $7.50.

7. Richard M. Pearl, How to Know the Minerals and Rocks, Signet Key Book, $1.00.

8. Rocks and Minerals, A Golden Nature Guide, $1.35.

* Gemcutter's "bible"
** Excellent condensation

Magazines

1. The Lapidary Journal - Box 518, Del Mar, California.

2. Gems and Minerals - Mentone, California.

3. Rocks and Minerals - Box 29, Peekskill, New York.

Sources of Supply

Machinery - Pioneer Lapidary Equipment
513 - 8 Avenue, S. W. CALGARY, Alberta.

Green's Rock and Lapidary,
916 Centre Street, N. CALGARY, Alberta

Canadian Lapidary Supply,
612 MacLean Block,
CALGARY, Alberta.

These two dealers handle other supplies as well.

Mr. Arthur McMartin, 46 Westminster Drive, Calgary, has given instruction in identification and classification of rocks and also teaches courses in cutting and polishing. He would be willing to assist anyone who wishes to make inquiry.

APPENDIX "A"

TYPICAL PROCEDURE SHEET

SPARK PLUG SERVICING (Unit 6 (4) a)

JOB To service spark plugs

TOOLS REQUIRED - wire gauge, point file, sand blast cleaner, wire brush, spark plug socket (13/16) and rocket, torque wrench.

REFERENCES - A.C. or champion spark plug, servicing manual.

PROCEDURE - 1. Be sure spark plug wires can be identified correctly for reconnection if more than one cylinder is involved.

2. Remove spark plug wire (high tension lead).

3. Loosen, but do not remove spark plug.

4. Blow out dirt from around the base of the plug. (This prevents dirt entering the cylinder when plug is removed.) Protect your eyes.

5. Remove the spark plug.

6. Examine the spark plug electrodes and porcelain for possible damage.

7. Clean the plug using the sand blast cleaner. (Rotate while applying the blast.)

8. Using the point file, file the electrodes square.

9. Using the wire gauge bend the outer electrode to get the proper air gap. (Check manufacturer's specifications for correct clearance.)

10. Clean spark plug seat and porcelain.

11. Using a new seat gasket (copper ring) if one is employed, install the plug finger tight.

12. Using the torque wrench, tighten to specified tension. (See manufacturer's manual.)

13. Connect terminal. (If more than one cylinder is involved - the order is important.)

14. Replace tools and clean up your work area.

15. Start engine to check performance.

TYPICAL PROCEDURE SHEET

QUESTIONS ON SPARK PLUG SERVICING NAME _____

1. As the length of service of a spark plug increases, the air gap between the electrodes (increases, decreases), WHY?

2. Spark plugs are available in different heat ranges depending on the application. The hotter the plug, the (longer, shorter) the porcelain.

3. A plug that operates too cold is apt to be (a) blistered (b) carboned (c) blue

4. In adjusting the spark plug air gap, always bend (a) the outer electrode (b) the centre electrode (c) both electrodes

5. Why was the torque wrench used to tighten the spark plug?

SAMPLE TEST IN ELECTRONICS

A Sample Test Based on Book I - Minivac 601

1. What is the voltage output of the power supply used in Minivac 601?
   Ans. _____

2. Is this a D.C. or an A.C. voltage? Ans. _____

3. When using the binary input, how many symbols are used? Ans. _____

4. What do the following abbreviations mean in the binary output?

   N.C. means _____

   N.O. means _____

5. What are the slide switches for? _____

   _____

   _____

6. What is meant by energizing a relay? _____

   _____

   _____

7. If light 6 in the binary output is "ON", what number does it represent?
   Ans. _____

8. What is the purpose of the circuit breaker in the computer? _____

   _____

   _____

9. How many symbols are used in the decimal number system? Ans. _____

10. What symbols are used in the binary number system? Ans. _____

11. When the rotary switch is used as a decimal input, is it operated manually or by the electric motor? Ans. _____

12. Write a program which will enable relay 2 to put light 2 "ON" when you press pushbutton 2 down.

APPENDIX "B"

WOOD WORK

Exercise Block

1. Planning:

a) Obtain a piece of rough lumber approximately 4 1/2" x 9" from your instructor.

b) Carry out the following operations. Refer to the diagram for details whenever necessary.

c) This exercise should be completed in two double periods. At the end of this time whether it is finished or not give it to your instructor for marking and carry on with your next project in wood.
Your mark will depend on your quality of workmanship as well as how much you have done.

d) Refer to the book "Stanley Tool Guide" for the correct way to use the tools. Your instructor will be around to demonstrate some of the tools but rather than wait for him look up the procedure in the book.

2. Procedure:

a) Plane the Face:

i) Clamp the wood securely in the vice with the face side up and about 1/2" above the bench level.

ii) Use a Jack Plane to plane the face smooth and level. Do not try to take a shaving that is too thick.

iii) Test the face with the edge of a square for flatness - length, width, and diagonally.

iv) Check and mark OC when it is finished.

b) Plane the Edge:

i) Reclamp the piece of wood in the vice with the edge up and about 1" above the bench level.

ii) Plane this edge smooth, straight, and square with the face you just finished.

iii) Check and mark with OC.

c) Cut One End Square:

i) Use a scribe and square to mark one end of your board (about 1/4" from the end) square with the edge you just finished.

ii) Mark a line down the edge square with the face and lined up with the line across the face.

iii) Cut with a backsaw and bench hook following both lines.

iv) Check the end to be sure it is square with the finished edge and square with the finished face. Mark it.

NOTE: You should now have a finished face, edge and square end from which all your measurements may now be made.

d) Plane the Second Edge:

i) Set a marking gauge at 4" and check it with a ruler.

ii) Place the head of the marking gauge against the finished edge and drag the pin lengthwise along the finished face of the board.

iii) Plane the second edge to this line. Be sure it is flat, even with the line all the way, and square with the face when you are finished.

iv) Check the width of your board to be sure it is 4" all the way along the board.

e) Plane the Second Face:

i) Use a marking gauge to mark the desired thickness (3/4") all the way around the board.

ii) Keep the head of the marking gauge tight against the finished face all the way.

iii) Plane the face until the board is the same thickness all over.

iv) Check and mark it.

f) Cut to Correct Length:

i) Measure the correct length accurately and draw a line across the face square with the first edge, and down the edge square with the face.

ii) Cut with a backsaw and bench hook following both lines.

iii) Check to be sure it is square with the edge and the face. Your block should now be the correct size.

g) Have your instructor check your work. If he is too busy at the moment carry on with the next steps until he is able to check it.

h) Layout of the corner, round hole and square hole

i) Round Hole: Use a try square to locate the two center lines and draw them the same as in the diagram.

ii) The Round Corner: Use dividers set at the correct radius to draw the corner as in the diagram. The corner markings should blend with the side and the end of the board without any sharp breaks. The center of the round hole is also the center of the corner radius.

iii) Square Hole: Use a try square to locate the center of this hole and draw the two center lines. Measure from the intersection 1/2" out on each line and use a try square and pencil to draw the square.

iv) Chamfer: Draw a sharp pencil line on the top face of the board 1/4" from the edge and parallel to it. Draw another sharp pencil line on the edge of the board 1/4" from the top face and parallel to it.

i) Drilling the Round Hole:

i) Use the brace and a 3/4" (#12) auger bit.

ii) Using a try square to be sure you are drilling straight, drill the hole until the feed screw point just shows on the other side of the board.

iii) Remove the bit from the board.

iv) Turn the board around and drill back from the other side of the hole to get a clean hole.

j) Cutting the Round Corner:

i) After your instructor has explained the proper use of the bandsaw, use it to cut the round corner. It has a fairly wide blade so don't try to turn too sharp with it.

k) Cutting the Square Hole

i) Clamp a bench hook in the vice and lay your board on it. This is to protect the bench.

ii) Hold the 1/2" chisel by the blade near the cutting edge so that you can rest your little finger on the board. This helps you to guide your chisel.

iii) Use a mallet or a claw hammer to begin cutting a square in the center smaller than the finished hole will be.

NOTE: You can hit the chisel fairly hard when cutting across the grain but use only light taps when cutting with the grain or you will split the board.

iv) Gradually enlarge the size of the starting hole until you have made it the desired size. Then continue 1/2 way through the board. Be sure it is flat on the bench hook so that the back of the board does not split away.

l) Chamfer:

i) Clamp the board horizontally in the vice with the corner to be chamfered on top and toward you.

ii) Use a block plane held at 45° to the face and the edge of the board to plane the chamfer until you just reach the pencil lines you drew. Hold the plane firmly and take a shaving off the full length of the board to get the chamfer flat and uniform.

m) Sanding:

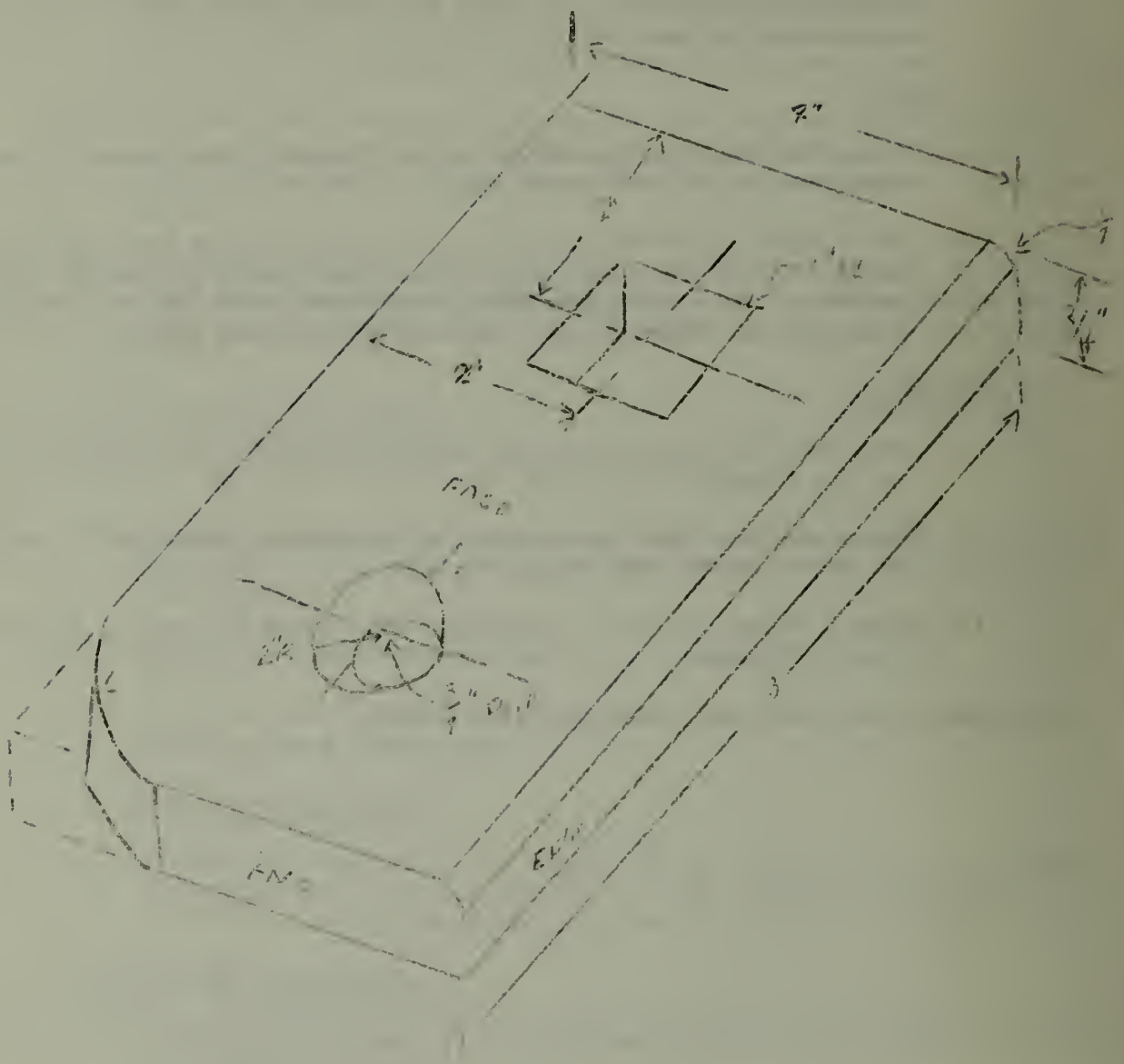
i) Sand with the grain only (not across the grain) and keep the corners sharp.

ii) Use a sanding block and a piece of 2/0 garnet sandpaper to smooth the surfaces and ends of your board.

iii) Repeat using 4/0 garnet sandpaper and remove all pencil lines and other blemishes.

n) Have your instructor evaluate your work.

WOODWORK "EXERCISE BLOCK" NAME _____



APPENDIX "C"

PLASTICS

JOB SHEET

Student's Name..... Class.....

Name of School..... Date.....

THE JOB: To Heat-Seal Plastic

Many things are now packaged in polyethylene bags, particularly items of clothing returned from the dry cleaner, or items purchased from the fruit and vegetable counter of grocery stores. You can use the material from these bags to make photo and card protectors, book covers, furniture protectors, picnic bags, and many other things.

Since many of these things will require sealing of larger or longer areas, it is a good idea to make a number of long heat-sealing rods which can be heated at the same time. Rod lengths cut from metal coat hangers do nicely for this work.

PREPARATION:

Before starting this experiment you will have to prepare a place to work. Somewhere near the oven is preferable. Use a pad of newspaper or a piece of smooth cardboard to protect the table or bench where you will do your heat-sealing.

TOOLS AND MATERIALS:

Polyethylene bags, Mylar film, copper or other metal rods, pliers, knife or ruler, oven, card or photograph, newspaper or smooth cardboard.

PROCEDURE:

1. Take a piece of polyethylene and Mylar film.

2. Fold the polyethylene into a small flat case. If you wish, you can fold it over a photograph or card that you wish to preserve.

3. Heat the oven to 500 degrees and put in the copper rod. Make sure you have the pliers handy for removing it from the oven.

4. Place the Mylar film so that it covers the edges you wish to seal.

5. Remove the copper rod from the oven and place it on the Mylar over the area you wish to seal. Press the rod down firmly with the back of the knife or the ruler and rock it back and forth to widen the seal area.

REFERENCE:

Plastics Engineering Manual, Lionel Engineering Series, p. 11, the Lionel Corporation, 15 East 26th St., New York 10, N.Y.

QUESTIONS:

1. What tools and materials are required?
2. Why do we use the Mylar film?
3. Why is the rod rocked back and forth?
4. Why do we use the knife or ruler?
5. Why is copper rod superior to ordinary metal rod?
6. What is the purpose of the newspaper or cardboard?
7. Why do we work near the oven?

APPRAISAL:

1. Is the finished job clean and neat?
2. Are the seals close to the card or photograph?
3. Is the margin uniform and square?
4. Is the finished job smooth and free from wrinkles?

TEST ON KNOWLEDGE OF PLASTICS

1. Which plastic was discovered during a search for a substitute for gasoline?

   (a) Polypropylene (b) Polystyrene
   (c) Polyethylene (d) Cellulose acetate

2. Molecules in plastics are arranged in:

   (a) very tight circles (b) small groups
   (c) very long chains (d) equal spaces

3. Plastics which do not soften each time they are heated are called:

   (a) thermoplastics (b) vinyl resins
   (c) plastisols (d) thermosetting plastics

4. Which of these plastics is methyl methacrylate?

   (a) Delrin (b) Cycolac
   (c) Plexiglas (d) Nylon

5. Which of these plastics is hard to scratch with a fingernail?

   (a) Lucite (b) vinyl
   (c) styrene (d) nylon

6. Which of these plastics is lightest?

   (a) cellulose acetate (b) polypropylene
   (c) nylon (d) cycolac

7. The principal method of forming thermoplastics is:

   (a) injection molding (b) slush molding
   (c) foam casting (d) transfer molding

8. Because burning plastics can result in strong, unpleasant odors and thick black soot, you should take this precaution:

   (a) burn all of your plastics at once (b) test only small pieces at a time
   (c) test late at night (d) wear heavy gloves

9. Why should you clean the tweezers after each burning test?

   (a) to test your ability to clean (b) to make the tweezers last longer
   (c) to make sure the next test will be accurate (d) to cool off the tweezers

10. Which of these films is the toughest?

    (a) polyvinyl alcohol (b) Mylar
    (c) cellophane (d) oriented styrene

		True	False
11.	Thermosetting plastics cannot be used near heat because they melt easily.	____	____
12.	Most plastics float (are lighter than water).	____	____
13.	Methyl methacrylate rod breaks easily when nicked.	____	____
14.	Delrin is softer than Lucite.	____	____
15.	Polyamide is the same substance as nylon.	____	____
16.	The Echo I satellite was made of cellulose acetate.	____	____
17.	All thermosetting plastics will dissolve in acetone.	____	____
18.	Thermoplastic means the plastic cannot be melted.	____	____
19.	Bakelite is a thermoplastic.	____	____
20.	Cellophane is a plastic.	____	____

21. Which one of these plastic rods is toughest to bend?

(a) vinyl (b) polypropylene
(c) delrin (d) cycolac

22. Which of these plastics reminds you of rubber?

(a) vinyl (b) styrene
(c) delrin (d) cellulose acetate butyrate

23. A substitute for acetone would be:

(a) lemon juice (b) rubbing alcohol
(c) turpentine (d) fingernail polish remover

24. Since acetone is poisonous, likely to catch fire, and quick to evaporate, you should:

(a) not use it with plastics (b) always keep the bottle in a safe place
(c) mix it with water or oil (d) pour it into another bottle immediately

KEY TO

TEST YOURSELF ON PLASTICS

1. C	7. A	13. T	19. F
2. C	8. B	14. T	20. F
3. D	9. C	15. T	21. C
4. C	10. B	16. F	22. A
5. D	11. F	17. F	23. D
6. B	12. F	18. F	24. B

INFORMATION SHEET
for
PLASTICS

A Short History of Plastics:

A century ago synthetic plastics were unknown in the United States. In 1868, the first commercial plastic, cellulose nitrate, was discovered almost by accident by John Wesley Hyatt, a young Albany printer in an effort to win a $10,000 price for finding a material to replace the scarce and costly ivory then used for billiard balls.

Called celluloid, this first American plastic soon found many other uses. It provided our grandfathers with their stiff collars, cuffs, and shirt fronts and made window curtains on the early automobiles. The first photographic plate, made on celluloid instead of glass, made its appearance in the 1880's. The first celluloid motion picture film was made in 1882.

Forty-one years passed before the infant plastics industry took another step. In 1909 Dr. Leo Baekland developed the first thermosetting material (phenol formaldehyde) which was christened Bakelite after its inventor. This hard, heavy, and medicinal-smelling plastic found early use in bowling balls and in phonograph records. In an improved form it is still widely used for heat-resisting handles for pots and pans, electrical appliances, and clock and transformer cases.

Starting in 1927, however, new types of plastics were developed with great rapidity. Cellulose acetate appeared sandwiched between two sheets of glass, in shatter-proof automobile windows. The first of the vinyls appeared on the market during the same year. The tongue-twisting methyl methacrylate, known to most of us by the trade names of Lucite and Plexiglas, appeared at the same time. This was widely used for windshields and "blisters" in World War II airplanes.

From the period just preceding World War II to today, the developments in plastic have been so many and varied that a large encyclopedia is required to name and define them. Further developments in this field are to be expected.

The future of plastics may well be worthy of the imagination of the best of science fiction writers. After all, how many people a generation ago could envision the marvelous things done with plastics today----:

----A huge balloon in space
----Meals cooked in their plastic packages
----Plastic rocket bodies and nose cones
----Plastic glues (stronger than steel rivets)
----Plastic books you can read under water
----Plastic footballs, basketballs, and helmets
----Plastic clothes
----Plastic replacements for blood vessels
----Plastic replacements for parts of the human ear
You can make your own predictions!!!

Reference

Plastics Engineering Manual, Lionel Engineering Series, PP. 40-1, The Lionel Corporation, 15 East 26th Street, New York, N. Y.

Other References

1. Adams, John V., Plastic Arts Crafts, 1948, D Van Nostrand Co., Inc., New York, pp. 4-7.

2. Mansperger, Dale E. & Pepper Carson W., Plastics-Problems and Processes, International Textbook Co., Scranton, Pa. pp. 3-4.

3. Groneman, Chris H., Plastics Made Practical, Bruce Publishing Co., Milwaukee, Wis., pp. 1-2.

4. Cherry, Raymond, General Plastics, 1948, McKnight & McKnight, Bloomington, Illinois, p. 125

5. Cope, Dwight, & Dickey, Floyd, Cope's Plastics Book, Goodheart-Willcox Co., Inc., Chicago, Illinois, pp. 9-10.

SOURCES OF SUPPLY

CANADIAN

1. Bedford Fine Leathers Ltd., 578 Seymour St., Vancouver 2, British Columbia.
   (Complete leather and hobby supply catalogue)

2. Lewiscraft, 284 King Street West, Toronto 2B, Ontario.
   (Complete hobby and leather supply catalogue)

3. Tandy Leather Co., 9757 Jasper Avenue, Edmonton, Alberta
   OR
   519 Centre Street South, Calgary, Alberta.

4. Local Hobby Shops in your nearest city.
   - Baird's Leather Goods, 306 - 5 Street South, Lethbridge, Alberta

5. Uncle John's Hobby Shop Ltd., 329 - 7 Avenue S.W., Calgary, Alberta.

6. Don's Hobby Shop Co., Ltd., 610 - 1st Street S.W., Calgary, Alberta.

7. Treasure Island Hobby Shop, 10 Avenue & Centre Street, Calgary, Alberta.

8. Universal Hobby Supplies Limited, 623 - 8 Avenue S.W., Calgary, Alberta.

AMERICAN

1. American Handicrafts Co., Inc., 915 South Grand Avenue, Los Angeles 15, California.

2. Leather Art & Craft Supply, 7705 State St., Huntington Park, California.

3. The Longhorn Co., 3141 Oak Grove, Dallas, Texas,
   OR
   1713 McKinney, Houston, Texas.

APPENDIX "D"

CERAMICS

JOB SHEET

Student's Name..... Class.....

Name of School..... Date Begun.....

THE JOB: To Make An Original Free-form Dish.

If you wish to make ceramic pieces by casting but do not like to invest in commercial molds, then a free-form dish mold is an excellent activity. You may create your own original design, build the form, and make the mold. The mold may be used to make many pieces, but each will have a great deal of originality. The free-form dish mold is an excellent beginning project for those who are interested in making other more difficult molds. To make the explanation simple, the procedures are described in two parts: Preparing the Form and Casting the Form.

Preparing the Form or Shape:

Tools and Materials

Sheet of heavy paper such as oak tag or stencil paper, pencil, large lump of well-wedged clay, plaster bat, modeling tools, fettling knife, and sponge. A French curve as used in drafting will be useful.

Procedure

1. On scrap paper scketch a shape which you would like to see in a finished dish. Make a dozen or more sketches of various shapes and select the one you wish to develop. Use the French curve to help make the curves pleasing.

2. Choose the best design, develop it to actual size, transfer it to the heavy paper, and cut it out.

3. Work the lump of clay on the plaster bat with the heel of the hand until it is about the desired thickness for the finished dish. Keep turning and pounding the lump of clay on the bat to work out all of the cracks and air bubbles.

4. Use the fettling knife to carefully smooth the top of the clay so that it will have even thickness throughout.

JOB SHEET CONT'D

5. Place the paper pattern on the slab of clay. Carefully cut down through the clay, holding the knife at a slight angle, so that the bottom is slightly larger than the paper pattern.

6. Remove the excess clay and smooth the edges of the piece, using the fettling knife and a damp sponge. Do this very carefully. Make the shape just as smooth as possible. The more perfect this is, the smoother the finished piece. Any defect in the form will be faithfully reproduced in the finished mold.

The shape is now ready to be used for making the mold which may be made immediately, or the form may be kept in a plastic bag until ready for use. (See Job Sheet No. 2.)

Reference

1. Thompson, Seeley, Activities in Ceramics, pp. 49-50

Questions

1. Why is the lump of clay well worked?
2. Why must the clay slab be of even thickness?
3. Why is the bottom of the clay slab cut wider than the top?
4. Why must the clay model be perfectly smooth?
5. Must the clay model be used immediately?
6. How do we get the clay perfectly smooth?

Appraisal

1. Is the finished job perfectly smooth?
2. Is the bottom of the clay slab larger than the top all the way around?
3. Are the edges perfectly smooth?
4. Are there any "under-cuts" around the sides?

JOB SHEET No. 2

Casting the Form

Tools and Materials

Large pieces of glass or sheet metal, casting box or frame, mold soap sizing, sponge, fettling knife, plaster of paris, water, mixing cans, and a stirring stick.

Procedure

1. Place the shape (made in Job Sheet No. 1) on the glass or sheet metal. Seal the edges with soft clay so plaster can not run underneath it.

2. Adjust the casting box, allowing about two inches space on each side. Seal the form or box by placing thin coils of clay where the box makes contact with the glass or metal. This will prevent the plaster from leaking out during the pouring.

3. Size the clay shape with soap sizing, also the glass or metal sheet and the casting box to prevent the plaster from sticking. Wipe off excess sizing with a sponge. It is not absolutely necessary to size the clay shape, since the plaster will not stick to it; but a good soap size makes the plaster pull away much more easily.

4. Mix the plaster. Follow manufacturers instructions. It should be the consistency of thick cream.

5. Pour the plaster slowly into the box. Try to avoid air bubbles.

6. When the plaster has set, the box may be removed. If the shape contains no "undercuts" and was well sized, the hardened plaster will be easy to remove from the clay, leaving the shape intact. More molds may be made from this shape if desired.

7. Trim the edges of the plaster mold and put it aside to dry thoroughly.

8. The mold may be further sanded and smoothed when it is thoroughly dry. It will then be ready for casting.

Reference

1. Thompson, Seeley, Activities in Ceramics, pp. 50-51.

Questions

1. Why are the edges of the clay shape sealed?
2. How much space should be allowed on each side of the form?
3. Why is the box sealed to the glass or metal?
4. Why do we size the box and metal?
5. How do we avoid air bubbles in the plaster cast?
6. How is the plaster cast smoothed?
7. Can the mold be used immediately?

Appraisal

1. Are the edges of the mold all trimmed?
2. Is the mold smoothed?
3. Did you return the clay to the clay bin?
4. Are the working surfaces cleaned up?

INFORMATION SHEET

POTTERY

Evidence seems to indicate that the origin of pottery on the American continent goes back no farther than 500 B.C. Since then several centres of ceramic development have come and gone. The greatest of these centres were in Peru, Guatemala, and in the Valley of Mexico, during the period 500 B.C. to A.D. 1500. In the southwest United States, pottery-making began about A.D. 500 and developed until the Spanish Conquest in the sixteenth century. Pottery with painted design in lead glaze has been found in the Southwest.

The first American pottery was a porous ware, generally of buff or red clay with painted designs in color. The coil method was used; the potter's wheel was not. The designs went through periods of realism and conventionalism. Today's pottery by the American Indian in the Southwest is still decorated with conventional symbols and is characteristically soft, porous, and unglazed.

Production methods used in the manufacture of pottery and dinnerware in the United States today are definitely more American than is the style and design of the ware. Much of our dinnerware is traditional in pattern, but the methods by which it is produced are the ultimate in modernity. English and French influence is still common in dinnerware patterns, but we are manufacturing in mass quantities ware that is superior in clay body to that of other countries. To get the finest ware, we no longer need to import. Mass production methods have not tended to raise the quality of the design, however. This is disappointing, but now and then fine patterns appear which are less bound by tradition. Perhaps within the next decade or two most American pottery will actually show the influence of the American spirit in its design. A distinct trend in this direction is now apparent.

APPENDIX "E"

LEATHER CRAFT

INFORMATION SHEET

How Leather is Graded

Grading methods in leather were devised for use in selling to factories which make garments, shoes, and other leather items. The terms are understood in the industry. It has been only in recent years the general public became interested in buying leather for the making of garments, bags, belts, and other items. To the public the terms used are often confusing.

No machine has been invented that will grade leather. It is strictly the work of a human who has been trained in the art of tanning leather and can tell the value of each skin by "sight and feel".

Some tanneries call their grades A, B, C, D, DX, others 1, 2, 3, 4, etc. These markings or gradings have no relationship to WEARING QUALITY. One should always remember that grade "B" or "C" is not a lower QUALITY than grade "A". The leather has all been tanned exactly alike from the identical types of hides, so there can be no difference in QUALITY of any of the finished leather.

Only a very small percent of these skins will grade "A". As a result, the price for what little "A" grades there are, will be high. The finest steaks always bring more money than the less desirable cuts. The same applies to leather. The difference comes about due to the usable portion of the tanned hide. Its imperfections, scratches, brands, holes and stains that make the difference in grading.

Often leathercrafters will find it to their advantage to buy "C" grade because they can cut around the imperfections and use the smaller pieces for small projects. Many of the slight imperfections in "B" or "C" grades can easily be tooled out. For such work, choose the pattern that will cover up most. Sometimes if the scar is somewhat deep, you can work it right into the design with a camouflage tool or veiner. We again mention that there is only a very limited amount of "A" grades--never sufficient quantities to take care of the demand.

Hides on which the tanning process has been "rushed" will produce a leather having either raw or hard spots. Hides that have started to decay should not be made into leather, neither should hides be used from animals that died rather than having been slaughtered. Leathers from the above should never be graded and sold excepting with their true character noted.

It is always well to remember that leather is not uniform as woven cloth. Hides differ due to the age of the animals, climatic conditions, care provided and even the season of the year in which they are slaughtered may cause a variation.

INFORMATION SHEET CONT'D

Always bear in mind the grade and quality of the leather bought and the price paid is based on the honesty and integrity of the tanner or dealer who sells it to you.

Reference

1. Tandy, Dave L., Leather Knowledge, Tandy Leather Co., 9757 Jasper Avenue, Edmonton, Alberta.

   OR

   Tandy Leather Co., 519 Centre Street South, Calgary, Alberta.

Other References

1. Cramlet, Ross, C., Fundamentals of Leathercraft, The Bruce Publishing Co., Milwaukee, Wisconsin, pp. 9-11.

2. Mannel, Elise, Leathercraft is Fun, The Bruce Publishing Co., Milwaukee, Wisconsin, pp 13-14.

JOB SHEET
for
LEATHER CRAFT

Student's Name..... Class.....

Name of School..... Date.....

THE JOB: To Sharpen a Leather Knife

Neat work in leather requires that all cuts be clean and precise. To get cuts like this requires carefully sharpened knives. The knife should cut the leather clear through in one clean stroke. Repeated cuttings leave ragged, uneven edges. Once knives have been properly sharpened the keen edges may be maintained by whetting them on a clean oilstone.

Preparation

1. Check the grinding wheel for trueness, chips, cracks, etc.
2. Adjust the tool rest to 1/16" clearance.
3. See that eye shields are available and used.

Tools and Materials

Grinding machine, eyeshield, hone, strop, leather knife, Jeweller's rouge, water for cooling.

Procedure

1. Hold the knife firmly in both hands, with light, firm pressure.
2. Make a light uniform pass the length of the blade across the stone.
3. Check the blade for the uniformity of the grind.
4. Reverse the blade and grind with a light pass as before.
5. Check the blade edge. Repeat steps 2 to 5 if necessary.
6. Hone the blade edge. Be sure to remove the wire edge.
7. Strop on a leather strop treated with Jeweller's rouge.
8. Repeated honing and stropping should maintain this edge for a considerable time.

Questions

1. Should the blade be ground every time the knife is sharpened?
2. Why do we inspect the wheel each time we use it?
3. Why do we hone and strop the blade after grinding?
4. Why do we use very light pressure when grinding the blade?

Appraisal

1. Is the grind bevel uniform and straight?
2. Is the wire edge fully removed?
3. Is the edge honed to uniform keeness?

APPENDIX "F"

GRAPHIC ARTS

A. Making a Rubber Stamp:

1. Planning:

Sketch your name and your address as they are to appear when you use your rubber stamp. This must be an arrangement similar to that in the sample.

2. Acquaint yourself with the type:

- Go to the type cabinet and note the labels on the cases.
- Compare the different sizes and kinds of type and note the location of the nicks on the different type.
- The nicks are in a different position for every style and size of type.
- The type is kept in individual compartments which vary in size to accommodate the different characters.
- The layout is called a California Job Case.
- Study the California Job Case Plan on the back of the door above the type cabinet.

- You will use the 14 point Gothic Type for your rubber stamp.
- There are two fonts of this type in the cabinet.

3. Composing the Type:

a) Set your job stick at 15 ems and hold it in the palm of your left hand. Your thumb should be over the top to hold the letters in place as you set them.

b) Begin with a 15 em slug (thick one) in the job stick.

c) You are now ready to set your first row of type.

Begin in the bottom left hand corner with an em spacer followed by your name using upper (capitals) and lower (small letters) case letters.

- Use an en spacer between words and an em spacer at the end of the line.
- Center your first line in the job stick by putting quads of equal size on each end of the line. (It will take 2 slugs and one lead together to give you the thickness of the 14 point type)
- Justify (make it snug) your line using the thin 3 em, 4 em, or 5 em spacers then one or two brass or copper spacers.
- Check your job to be sure all the nicks on the letters are visible.
- Put in a 15 em lead (thin one) along your line of type to separate the lines.

d) You are now ready to set the second line of type.

- Begin with an em spacer.
- Set your house address.
- Use en spacers between the groups of numbers and the words.
- Finish the line with an em spacer.
- Center, justify, and check your line as before.
- Put in a 15 em lead.

e) You are now ready to set your third line of type.

- Proceed as with the first two lines of type but this time use only upper case letters for the word EDMONTON, and both upper and lower case letters for Alberta.
- Center, justify, and check your line as before.
- Finish with a 15 em slug.

f) You have now finished composing the type.

g) Check your job for:
- correct letters
- punctuation marks
- centering.

h) Do NOT remove your job from the job stick yet.

i) Have your instructor check your work to this point.

4. Job Storage

If it is necessary to store your job until the next period, do it in the following manner, otherwise skip these steps and go on with No. 5, "Lockup".

a) Lay your job stick lengthwise inside the galley.

b) Hold your job securely with one hand and remove the knee (the clamp) with the other hand.

c) Using both hands to hold your job from coming apart, slide it into one corner of the galley. DO NOT LIFT THE JOB.

d) Replace the knee and hang up the job stick where it belongs.

e) Tie the job securely with a piece of string 2 feet long. Wrap it around several times tightly, then tie it.

f) Place all jobs in the class galley ready to be stored.

5. Lock-up in the Chase

a) Place the special rubber stamp machine chase on the marble slab beside the letter press.

b) Switch on the rubber stamp machine and set the black dial at 9 (350°F.).

c) Use both hands to remove your job from the job stick or galley and slide it into the center of the chase.

d) Use 15 em furniture and one quoin to fill out the spaces between the job and the long sides of the chase.

e) Use 40 or 50 em furniture and one quoin to fill out the spaces between the ends of your job and the end of the chase.

DO NOT TIGHTEN THE QUOINS YET

f) Use the thin furniture to get as snug a fit as possible without force.

g) Line up the quoins with the job and have one piece of furniture between them and the chase. Do not have the steel quoin next to the steel chase because it may slip.

h) Tap the type gently using the planning block and the rubber mallet. This is necessary to make the type level and to be sure that the letters are down. If you hit it too hard you may break the type.

i) Using the quoin key, tighten the quoins just enough to keep the job tight in the chase.

DON'T TIGHTEN THEM TOO MUCH

j) Lift one side of the chase about 1/2" and watch for any loose letters in your job. A loose line of type is tightened by loosening the quoins and inserting one or two copper spacers in the line. Then retighten the quoins. Check again for loose letters.

k) Leave the chase on the marble slab.

l) Have your instructor check your work to this point.

6. Making the Rubber Stamp

THE MATRIX

a) Place the chase containing your job in the rubber stamp machine to preheat for one minute. Be sure that the machine has reached the operating temperature before doing this. The needle on the temperature dial should be pointing at the 4 in. 400.

b) Place your piece of matrix on the job with red side down on the face of the type.

c) Place the sheet metal plate over the whole chase and matrix.

d) Pump in the lower platen to a slight kiss.

e) Allow one minute to preheat.

f) After preheating,pump up until very tight. Be careful that you do not pull the machine over.

g) Set the timer for 10 minutes. Allow to stand. During this interval begin reading your job sheets on "Composing a Business Card". Sketch your card as it will look when it is printed.

h) After the timer rings release the lower platen by turning the verticle release 1/2 turn to the left. Do not turn it more than 1/2 turn.

i) Use the asbestos gloves to remove the chase from the machine and pry off the matrix carefully.

j) Have your instructor check the matrix before continuing.

THE RUBBER STAMP

k) Peel off the holland cloth backing on the rubber and lay the cloth in the center of the plate.

l) Lay the rubber on the cloth with the newly exposed side up.

m) Lay the matrix on the rubber with red side down.

n) Carefully insert the plate in the rubber stamp machine.

o) Close the verticle release - turn to the right until tight (1/2 turn).

p) Pump up the platen to a slight kiss, and leave for one minute.

q) Release lower platen 1/2" and let gas escape and then pump up until you can see the rubber, squeezing out the sides about 1/8".

r) Set timer and let cook for 6 minutes.

CURRICULUM GUIDE